The FOUNDRY

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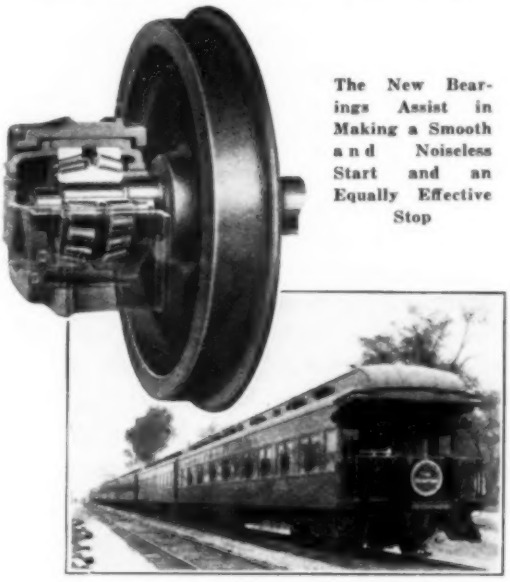
Castings Help in Smoothing Railroad Traffic

SPURRED by demands of the traveling public for greater speed and comfort with complete safety, the railroads have developed engines, rolling stock and track materials which have added greatly to the pleasures of railroad travel. In recent years many of the leading railroads have experimented with roller bearing car journals to increase the smoothness and ease of operation. This equipment is said to permit quicker acceleration and to decrease the cost of maintenance and operation. Considerable publicity was given antifriction bearings early in the summer when two luxurious trains operating between Chicago and Seattle on the Chicago, Milwaukee & St. Paul railroad were equipped completely with roller bearings. That type of equipment also was used on many of the electric railway cars exhibited at the recent railway show at Cleveland. As has been the case in majority of the developments in the railroad industry, the foundry plays an important part in the new development, since the complete journal box, consisting of inside and outside housings and the cover, are products of the foundry.



The New Bearings Assist in Making a Smooth and Noiseless Start and an Equally Effective Stop

Find Where Castings May Be Sold.

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STUDY THE BUYER

BY HERBERT R. SIMONDS

EVEN a good salesman has his off days. Harry Paulson, salesman for a jobbing foundry and enjoying the distinction of being successful in this line, ran into a series of off days in the early fall and, somewhat puzzled, stopped to take stock of the situation. While idly looking over his mail, he came upon an advertising letter from a typewriter supply house. It started out with the plea "won't you come back to us?" and the chief sales argument was the offer of a premium fountain pen if the prospect would only come back as a customer.

The fallacy in this method of approach at once was apparent to Harry. He remembered salesmen in his acquaintance who had used the same method in looking for castings orders. One salesman, a nice appearing old gentleman, had even been known to shed a few tears in the purchasing agent's office to further his appeal for an order. Of course, there is a strong personal factor in most selling and buying, but when such personal factor is used as the chief argument the effectiveness immediately is lost. The typewriter supply house that says in its letter "won't you please come back" indicates at once to the intelligent buyer that there is not much which it can say about its product.

While pondering over this typewritten sales letter, Harry picked up a recent copy of the *New England Purchaser* and read the following bit of experience written by a purchasing agent of a large manufacturing plant:

"The first man came in. He was selling typewriters. Considering the fact that we have many typewriters, we long since standardized on one machine after a careful trial. This man was a good salesman and knew his stuff. 'Yes, I know you did go into the matter carefully, but you have not tried out our machine since we made some improvements which make it by far the best on the market!' I allowed that perhaps what he said was true, but added we would have to worry along for a while before opening up the proposition again, especially as three other salesmen for as many other makes of typewriters had told me the same thing within a week.

"The next man in was selling ink which 'dried the moment it touched the paper.' He had a quart of that ink in his hand and apparently expected to sell it to me for cash. His concern was unknown to me. He slammed the door on the way out.

"The next man wanted permission to go into the shop and try out his lubricating oil. He was sure he could save us money although he did not know what oil we were using or what our requirements were. The next was the man whose lubricating oil we had been using with satisfaction. He came in to see that everything was going all right and did not overstay his welcome. He is a good man.

"Then came a man selling tires. He is another good man. He did not try to make a sale on the first call."

Here was some food for thought. Harry, being one of the many salesmen who call on this particular purchasing agent, was prompted to think a little more of the purchasers' side of the question. The points to be gained from the purchaser's experience as Harry saw it, were; first that a general statement about superiority means nothing unless it is backed by some concrete evidence. If one foundry salesman claims to have the best castings, his competitor is almost sure to make the same claim.

"Somehow," thought Harry, "I must find an approach which at least will be unique."

The next point which Harry considered was to establish a background before attempting to sell. Entirely aside from questions of price and quality, the purchasing agent must have confidence in the integrity of the foundry back of the work.

The third point suggested by the article was the need of knowing a lot about the operations and needs of the company doing the buying. This

To Sell Your Castings

The Successful Salesman Must Find a Unique Approach, Establish a Background, and Be Familiar with the Needs of the Buyer Before Attempting To Sell

particular point Harry dwelt on for a long time. He always had felt that there was a need for scientific principles in selling, and knowledge of the use to which a casting was to be put was the first essential for satisfactory service.

The next point brought out in the experience of the purchaser did not strike Harry so forcibly. This was the advice not to try to make a sale on the first call. Several cases where he had secured nice orders on his first visit came to mind. However, as he got thinking over this point, he realized that three of the four plants where he had failed to get orders during the last few days had been "first call" plants.

One of these was the manufacturer of a special wrench put on the market some months previcusly. The question of price seemed to be about all the purchaser considered. Harry had quoted 8 cents on a small casting. He knew this was as low as he could go and still permit his foundry to earn a profit. The purchaser said he had been quoted 6½ cents by the Jones Foundry. The Jones Foundry, Harry knew to be a notoriously low bidder and as he had run into errors of judgment made by the Jones Foundry before, he did not at the moment question the purchasing agent. Now, as he thought it over, he saw that purchasers should not be alone in judging character; salesmen also must consider the character of the purchaser.

On a sudden inspiration, he took up the telephone and got the Jones Foundry on the line.

"Hello, Kelly, have you had the Excelsior Wrench Co. inquiry? I am not trying to tip you off to any business but this is a new concern to us and I am trying to get a line on it."

"Yes," said Kelly, "we have had that inquiry and I don't mind telling you that you are too low for us. You are welcome to the business. I give it up."

This was enough of a lead for Harry's purpose.

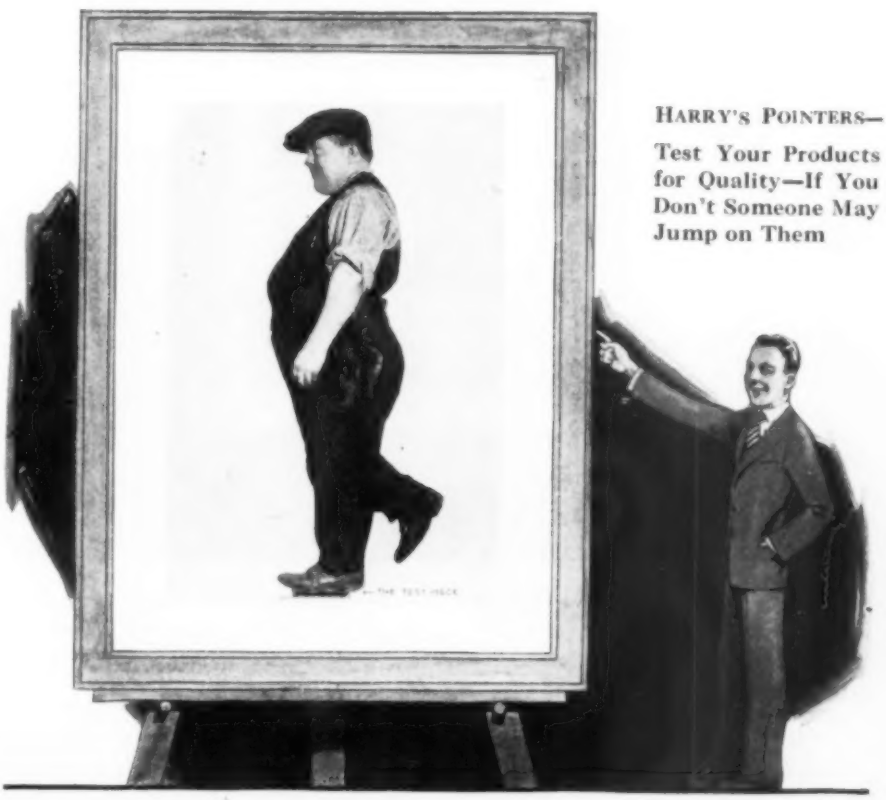
"Thanks old man," he said, "I will go after them."

He put on his hat and went back to the Excelsior Wrench Co. where he had been the day before. After some waiting, he was able to see the purchasing agent. This time he entered with a little more decisive step. A close observer would have noticed a little spark of fire in his eyes, although outwardly he was calm.

"There is an old Chinese proverb," he said in opening his conversation, "which says 'You fool me once; shame on you. You fool me twice; shame on me!'"

The purchaser colored slightly at realizing his trade tricks were known, but Harry was too much of a diplomat to carry his point further. Both men seemed to come to a better understanding and Harry came away with an order at 8 cents.

Many foundries that spend much effort and money in bettering their production methods, almost totally overlook the application of scientific



HARRY'S POINTERS—

Test Your Products for Quality—If You Don't Someone May Jump on Them

principles in distribution. The head of the sales department of a jobbing foundry must consider many features outside of the routine sales activity. He should study his customers' problems. He should know where his castings are going and to what use they are to be put.

Questions Operator

Some time ago the manager of a large plant making steel mill machinery, in wandering through his shops asked a question of a machine operator which revealed the fact that this operator had no notion of how the pieces he turned out day after day were used. The manager immediately had a moving picture made which showed not only where the different parts went in the assembly of complete machines, but the operations of the machines themselves in the production of rolled steel products. When the film was ready, he had it shown in the shops and let all the shop workers watch it at leisure on company time. Favorable results almost immediately were apparent and within a few months several valuable suggestions made by the operators were traceable to the increased understanding of the use of the various products afforded by the moving picture.

A jobbing foundry to fulfill its purpose, must in effect become a branch plant for each of its customers. In this light a suggestion for changes in design of castings may be made to improve operation of the customers' machine or to reduce cost.

The foundry sales manager should be alert constantly to the possibility of extending the use of castings. The general impression that the foundry industry is losing business to other classes of fabricated metal, may be traced to a considerable extent to greater publicity activity in other lines. The foundryman is notoriously a poor publicity man. If he supplants a forging or a rolled steel part with a casting, he says little about it, whereas the manufacturer of forgings who is able to introduce his product where castings have been used, makes a great noise about it and reflects credit to all other forging manufacturers.

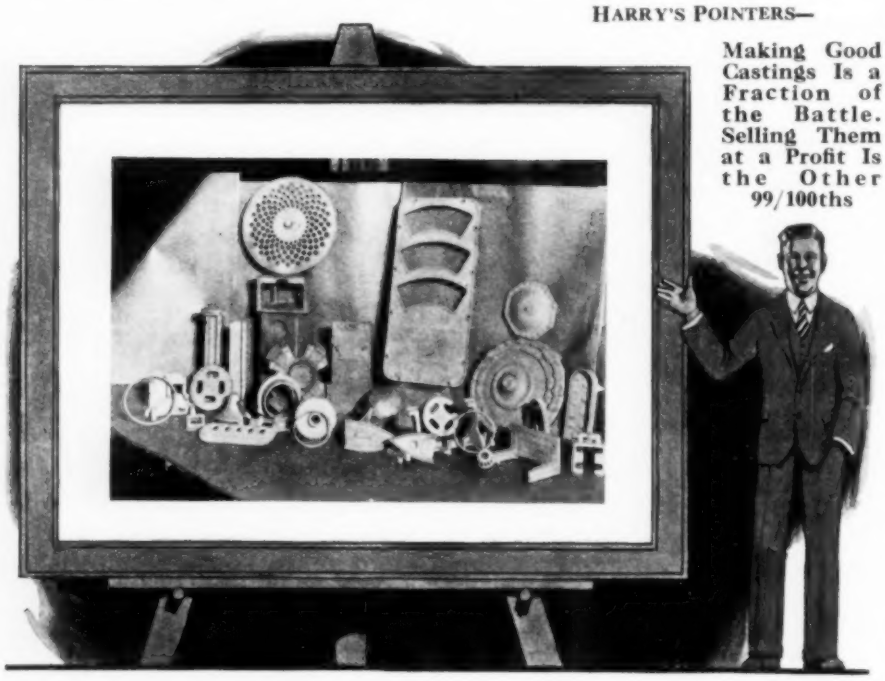
Harry Paulson, while appreciating this general tendency, does not see how the individual foundry can do much to help the situation. It remains for associations or committees of foundries to spread publicity work which will further the industry. A case bearing on this point is one of Harry's recent negotiations which happened to be with a wrench manufacturer although not with the Excelsior Wrench Co. He knew that this particular manufacturer was not using castings and as a result he might well have left the prospect alone as many other foundry salesmen had done for several years.

However, Harry was of an investigative nature. He quietly purchased three or four of the wrenches and took them into his foundry machine shop where he tested the different parts and in company with the shop foreman, thoroughly studied the mechanism. The result was that a week later he had made a new wrench of exactly the same design, but using malleable castings in place of forgings. He tested the new wrench in comparison with one of the wrench company's standard products and to his dismay found that his new wrench failed at a lower stress. That same evening, he and the foreman held a long session. The design of the castings used in the wrench was altered to give greater strength where failure had occurred. At other points the amount of metal was reduced A new wrench using these new parts then was made and comparative tests showed that it had greater strength than the wrench using forgings.

Thrilled with his discovery, Harry quickly made up a half dozen wrenches and took them to the manufacturer where he was able to demonstrate a lower cost and higher strength with practically the same weight. The result of this was a large order.

HARRY'S POINTERS—

Making Good Castings Is a Fraction of the Battle. Selling Them at a Profit Is the Other 99/100ths



Issues Challenge

The sequel to this little incident is of considerable significance. Harry's gain of course was somebody's loss and the manufacturer of forgings did not propose to sit idly by and let a foundry take away his business. Forgings, he argued, obviously were far better than castings no matter what the result of tests might indicate. The superiority of a forging is something which you cannot test. It has an inherent quality not to be in any way detected by observation, but to be distinctly felt by the user. The forgings manufacturer argued that his whole industry was involved in this issue—castings could not be allowed to supplant forgings in one case without challenging forgings everywhere.

Therefore, he persuaded a rival wrench manufacturer to advertise his product as made entirely of forgings with a slogan "are your wrenches made of forgings?" Then he pointed out this advertising to the manufacturer using castings and said "Can you afford to continue to use castings in the face of this advertising?" As yet nothing has happened, but Harry admits that his wrench manufacturer is worried. He feels that somehow the public as a whole should be more thoroughly sold on the strength and reliability of castings.

The foundry industry is too modest. When some one invents a new method of making a machine which does away with some castings, the average foundryman is too prone to throw up his hands in despair and say "There goes another attractive outlet for our products." The popular attitude toward castings is based to a large extent on conditions in the industry ten or 20 years ago. Since that time radical improvements in strength and reliability of castings

have been made. Harry knows about these improvements and he tells the wrench manufacturer, but this is not enough because the wrench manufacturer must meet the demands of his buying public and this public is not always well informed or highly discerning. Take for instance the question of polish on a wrench; obviously this does not effect the utility value of the wrench, yet each manufacturer tries to outdo his competitor by producing a higher and still higher polish. The retail hardware store which is to buy the product finds that the higher polished wrench sells more readily and therefore he wants to handle highly polished goods.

The question of selling castings even for the small foundry must necessarily include these larger considerations of popular demand. It must also include many other factors such as new uses for castings, new territory to be covered, better delivery service and better engineering service.

Sometimes a few off days react to the advantage of a salesman. They did in Harry's case. He studied a map and found that he could reach a new territory by water and after securing rates and shipping details from several companies, he invaded this new territory and secured several customers never before on his company's books.

HARRY'S POINTERS—

Disregarding Items of Cost Is a Quick Way Out—of Business

To Melt Continuously in a 40-inch Cupola

Question: We melt from 3 to 3½ tons per hour in a 40-inch cupola, but after 5 hours the furnace chokes with slag. The slag appears to run freely from the back of the cupola, but a quantity freezes around the tuyeres and gradually builds a bridge toward the center. We have been told that in several places the cupolas run continuously from the starting whistle in the morning until quitting time at night. We shall appreciate any information on the proper practice to pursue in melting iron in that manner.

Answer: The principal factors involved in the continuous melting process are high tuyeres, mild blast, liquid slag and charges of coke and iron in proper proportion. By proper proportion is meant a sufficient quantity of coke to melt the iron in a minimum of time and thus promote a steady descent of the iron through an incandescent zone. Where the coke or iron is used in excessive quantity the charge comes down in jerks with a stoppage period between the jerks. At each stop the blast has an opportunity to play steadily on one layer and partly chill it. The cumulative effect is to choke the cupola. For this reason small charges are melted under cleaner conditions than where the charges are increased to the limit.

Taking the various factors in the order indicated, high tuyeres promote clean melting because the blast enters the coke bed at a point well above the level of the iron and slag which collects in the well before it is tapped. Naturally the blast exerts pressure down as well as up, but whatever volume of blast travels downward has to pass through a thick layer of red hot coke before it comes into contact with the layer of molten slag which covers the iron. With high tuyeres also it is possible to provide a slag hole far enough below the level of the tuyeres to insure a free passage for the slag before it comes into contact with the cold blast.

Obviously, only a thin, liquid slag will run freely and therefore a sufficient quantity of limestone or other suitable fluxing material must be added to each charge to bring about this result. The amount will vary, depending on the character of the coke and the limestone and to some extent on the iron. More will be required with small, rusty scrap and sand cast pig iron, than with heavy machinery scrap and machine cast pig iron.

Without considerable more data than you have given we can not give you definite figures on the main features outlined. You probably will have to do a little experimenting before you get the cupola working satisfactorily. However, the following generalization may serve you for a foundation: Readjust the tuyeres about 24 inches above the sand bottom. Leave the slag hole where it probably now is, 10 or 12 inches above the bottom. Charge the iron and coke in the proportion of 1000 pounds of iron to 150 pounds of coke and throw a charging scoop full of limestone on each charge. The blower should deliver approximately 3000 cubic feet of air per minute at 8 ounces pressure.

A 40-inch cupola under proper operating conditions has a melting capacity of about 6 tons per hour.

Publishes Safety Codes

The American Engineering Standards committee has published two safety codes that should be in every foundry. One is a code for the protection of industrial workers in the foundry and is priced at 10 cents; and the other deals with the use, care and protection of abrasive wheels, price 5 cents. The committee also has under advisement a safety code for compressed air machinery, one on conveyors and conveying machinery and one on mechanical power control. Copies of the safety codes mentioned as being available may be obtained from the committee at 29 West Thirty-ninth street, New York.

Louis Cassier Co., Ltd., London, England, publisher of the *Metal Industry*, is publishing the *Iron and Steel Industry*, a new publication devoted to the iron and steel trade in the British Isles.

MAKING CORES in the DODGE FOUNDRY

BY J. B. NEALY

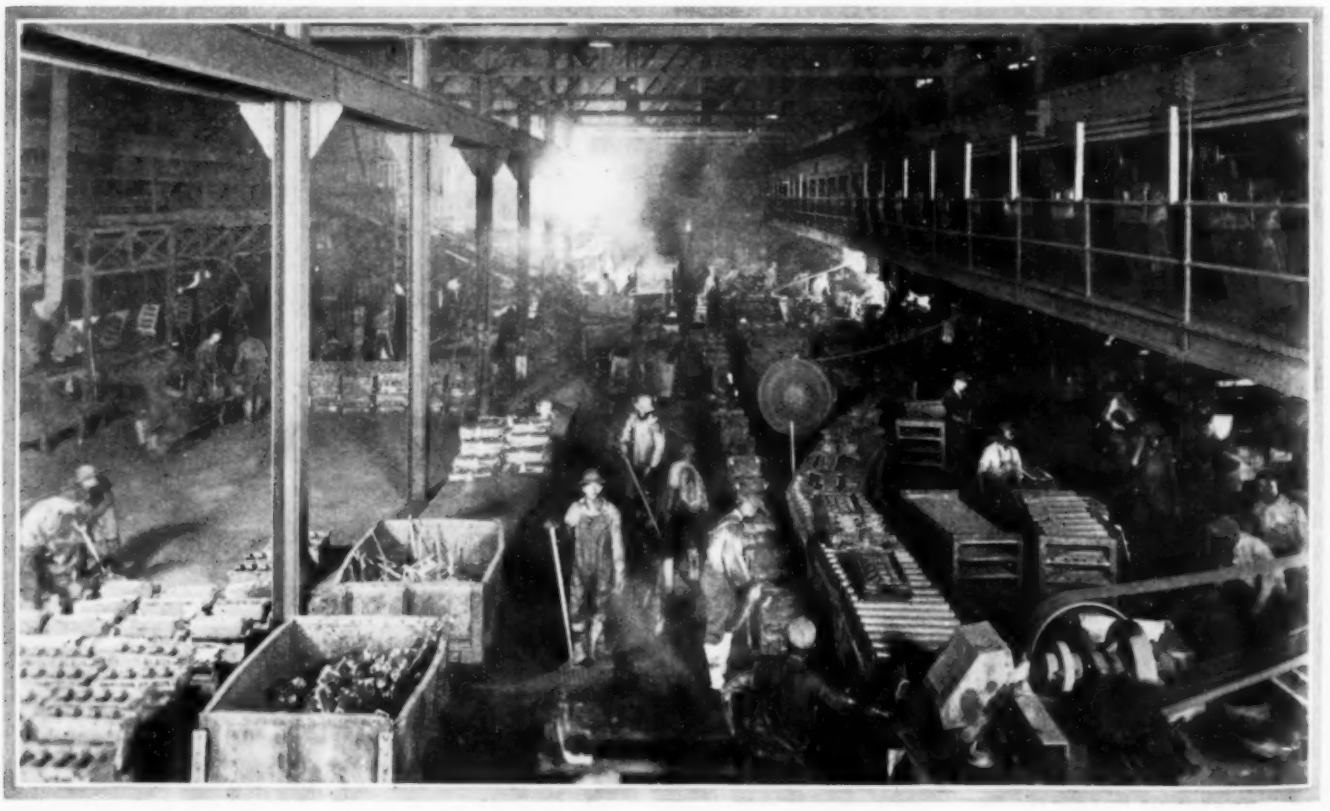
Automobile Manufacturer Produces Large Tonnage of Gray Iron Castings in Relatively Small Space

REFINEMENT of processes and synchronization of operations into continuous mass production are as vital to successful, modern foundry practice as they are to efficient mechanical production. Hence any changes in that department which speed output, better the product and reduce costs always are accorded their proper significance in the industrial world. Therefore, a brief description of the foundry of Dodge Brothers Inc., Detroit, which has the reputation of turning out an unusually large tonnage of castings in a small space, will be of particular interest.

While refinement and close application of existing methods, rather than the development of new ways and means, is the keynote of the success of this foundry, some radical improvements have been made, the most noteworthy of which is the method of baking cores. The work of this foundry, ranging from 1200 to 1800 sets of castings in a day, is produced in a 1-story building, 140 feet wide and 400 feet long.

An efficient and economic system of material handling consisting of overhead cranes, tracks with industrial trains, traveling slat and drag conveyors just above the floor, reduces nonproductive labor in the different processes and stages and speeds the output. Furthermore, all operations from the making of the mold to the machine shop are synchronized and controlled perfectly. This foundry uses the melt from four cupolas. The molten metal is conveyed to the pouring floor in 1-ton ladles, by cranes and monorails, where it is poured into 75-pound ladles and from these into the molds.

On one side of the foundry is a group of five closed loop drag type mold conveyors, three in one line and two in a parallel row, with a long sand and casting, or shakeout conveyor running between and beyond. The mold conveyors are about 80 feet long and 2 feet wide. On the



Conveyor Units Are Used Extensively In Transporting Molds, Castings and Flasks

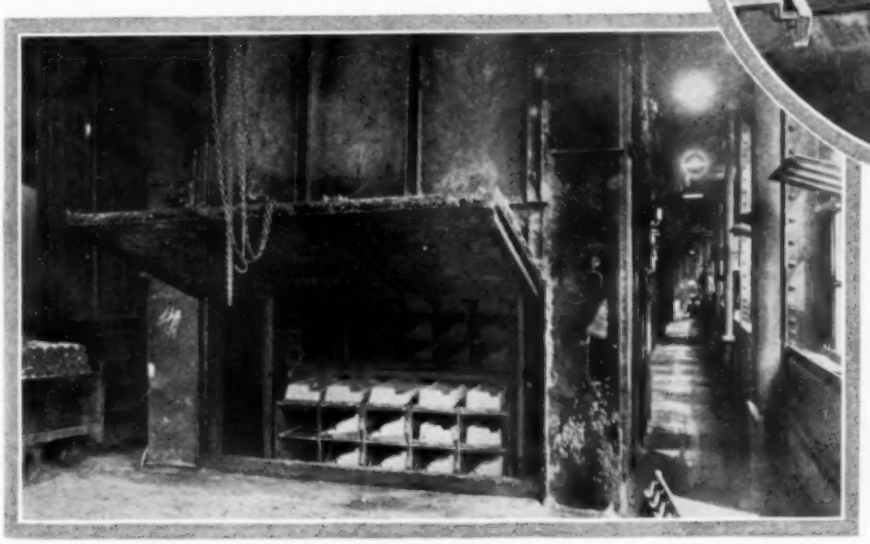
outer sides of the mold conveyors are rows of power molding machines. As the men make the molds they turn and place them directly on the conveyors. The molds are poured at the end of the conveyors and by the time they are traveling parallel to the cooling conveyor the castings are cool enough to be shaken out. Men standing between the two conveyors pick up the flasks, shake out

Above—Ovens Used in Baking the Cores Are Automatic in Every Operation. Cores in Foreground Are Ready To Be Taken to the Molding Floor. Left—Line of Core Making Machines

valve heads, etc. are made in the section of the foundry described. A similar system is used for casting the cylinder blocks except for a different type of conveyor and a transfer crane for moving the castings from the molding to the shakeout conveyor. Separate molding conveyors are supplied for the cylinder heads, gear case covers and manifolds respectively. A system of tracks with industrial engines and trucks move the parts to the grinding,

the sand and castings onto the long conveyor and return the cope and drag to the molding floor on the roller conveyor. The castings are removed farther down. The sand drops into a pit, where it is taken by bucket elevator to an overhead balcony and reconditioned, and then returned by belt conveyors to the hoppers serving the molding machines. Such parts as fly wheels, chain cases and covers, gear boxes, intake manifolds, water pump bodies, valve stem guides,

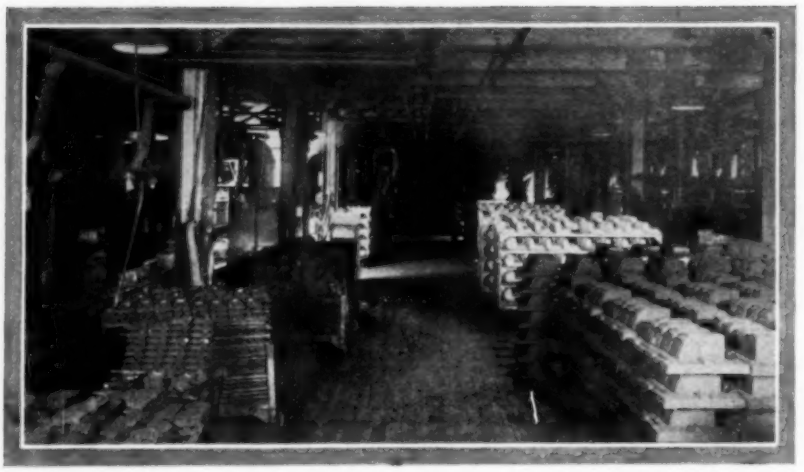
Below—End View of Core Oven With Door Open Showing Endless Chain Conveyor With Cores Traveling Through. Right—Removing Baked Cores From the Oven for Inspection



tumbling, welding, sandblasting departments or to the stock room or machine shop as required.

The first floor of the building in which the core department is located is used for cleaning and rough grinding the castings as they come from the foundry. That department is divided into two sections, the first being used for the cylinder blocks and the second for the smaller parts. The cylinder blocks are discharged onto

the floor from the shakeout conveyor, and allowed to cool about 6 hours. They then are placed on a conveyor which takes them through a series of 6 sand-blast units, a certain part being cleaned in each. They then are transferred to a traveling slat conveyor, with a row of workmen on each side, who grind and chip the different parts of the block as it passes along. After being water tested for leaks the block is sent to the machine shop. The smaller castings go to the tumblers and after being chipped and ground are sent to the machine shop.



A Storage Room Is Provided for Baked Cores

A high point of efficiency has also been attained in the core making department. This department is housed in a six story building with basement, a day's supply of raw material being kept in the latter. The core machines are located on the second floor, and the core ovens on the third floor, respectively. The core ovens are equipped with continuous traveling conveyors with cradles which leave the ovens through slots in the bottoms at either end, pass through the floor and ceiling and travel along in the core room below for the length of each oven. There are five of these ovens and conveyors and the core machines are located in rows along each side of the conveyors on the floor below. The operators make the cores and place them on the cradles. They then are moved up automatically through the ovens and down to same level again where they are removed.

Sand is elevated to bins on the fourth floor, delivered by chute to mechanical mixers on the third, where it is mixed with oil and other binders. It then is discharged into skid boxes and moved by electric trucks to hoppers directly over the core machines.

One of the five core ovens on the third floor, is used for drying cores made up of several parts pasted together. These ovens are each 100 feet long, 10 feet wide and 12½ feet high, and are fired with gas. Automatic pyrometric controls maintain a temperature of 450 degrees Fahr. in the core ovens. The baking periods range from 1½ hours to 3 hours and 35 minutes, according to the size of the cores being baked and character of core mixture. The baking period is controlled by the speed of the motor driven conveyors, which in turn are regulated by variable speed gears. These conveyors loop back and forth so that the work travels through the oven three times before coming out at the discharge end.

The temperature of the drying oven is held at 250 degrees Fahr. while the drying period is 50 minutes. These ovens are of sheet metal suitably stayed and insulated. Each oven is heated with 40 atmospheric gas pipe burners running across the oven near the bottom and firing directly into it. Gas is supplied at 1-pound pressure and loaded in both side walls of the ovens. Two

(*Concluded on Page* 887)

View of the Foundry Floor Showing Industrial Trains and Shakeout Conveyor in the Foreground

Distribution *Is Greatest* Gray Iron Problem

—the group idea offers means.

By A. J. Tuscany

THE present generation has witnessed many changes. These changes or advances in industry, trade and transportation which have taken place within the memory of many now living are more far-reaching and of more fundamental importance that those which may have taken place in a similar period of time in the past. Changes have been world wide. The boundary lines of countries have shifted. The position and importance of nations have been altered. Powerful countries have fallen and the development of other peoples who some years ago failed to attract world-wide attention, has gone steadily forward.

In our own country there can be no doubt that many far-reaching developments have taken place in late years. Not only has America become the creditor nation of the world, but she has set the pace for the remainder of the world in industry. Our production methods are emulated by practically every country on the face of the earth. Our workmen are living on a higher plane than the better classes of many other countries in the world.

What is more important to the subject under discussion, changes still are going forward.

Some industries have kept pace with developments on a more satisfactory basis than others. This age has seen the development of new methods of selling. An instance of this is the general use of the instalment plan of distribution. These changed conditions have been responsible for reduced activity among some of the older industries and, on the other hand, are responsible for greatly increased activities in other and newer industries.

For instance, the manufacturers of shoes are confronted by the problem of selling more shoes to keep pace with their production. It is related that the total number of pairs of shoes worn out is much less per person than was the case some years back. On the other hand, while shoe manufacturing has been confronted by this problem, the rubber tire industry has originated and in a few years has attained great prominence in this country's scheme of things.

New Competition Confronts

All of this has brought about a new competition in many lines. Not only does keen competition thrive within industries, but active rivalry of an energetic type has grown up between industries.

The foundry industry, while one of the country's basic and most important lines of endeavor, has not been given its proper credit for its share in the strides which America has made. The foundry industry is responsible for much more of the progress in this mechanical age than even thinking industrialists have recognized. In fact, it would seem at times that the stability and dependability of this good old industry, factors in its favor, have hindered a true appreciation of the part which castings play in the world of manufacture, transportation and utilization. The fact that the foundry industry is more or less under-rated is due in some measure to the lack of concerted effort on the part of those engaged in the foundry business.

It was not so long ago when America's productive facilities were unable to supply the demand. To dispose of the product of the foundries required little effort and the knack of selling was not developed as were other features of this business. The big problem confronting the average foundry, during times gone by, was to make castings as quickly and economically as possible. A number of conditions are responsible for changes over the old order of things. Increased production facilities, augmented to some extent by the World War, the development of new machinery, changes in methods of doing business in other industries, all have mitigated against the old practices in the foundry industry.

The average jobbing foundry today is selling its output on a hand-to-mouth basis. Industry is not buying in quantities for future consumption, as it did some years ago. Manufacturers have been educated to avoid

carrying a heavy inventory of semi-finished parts. Changes in design, demand, and the swing of the business cycle may find the manufacturer with an excess of certain parts which must be charged off. Further, the development to a high point of efficiency of the railroads of this country, the motor truck, the airplane and other modes of transportation all have proved to industry the ease of buying with assured deliveries as required. The experiences of many companies in 1920 and 1921 has made new markets and have kept their products to the forefront.

An interesting example of the influence of research and study on marketing a service and not a product is found in the case of the banks and trust companies. Years ago banks did not advertise. Today banks and trust companies are doing advertising in any number of different types and are profiting by it. All departments of the financial institutions have prospered. The amount of money in trust funds, for instance, is greater today than at any time in the history of the country.

Competition from the outside has made inroads into the production of our foundries. The foundry industry has done little to stem the tide of this competition. Americans are credited with being an aggressive nation; new suggestions and new ideas are accepted rather rapidly. This very propensity to seek the new and overlook the old has elicited considerable attention from inhabitants of other countries who visit our shores, but it may be one of the reasons why other products have made inroads into the business of the foundry industry.

We find the sheet steel manufacturers advocating with considerable success the adoption of sheet steel products in stamped, rolled and drawn form to supplant castings. We find the forging manufacturers are active in the same direction. We find the welding interests are advocating welded constructions of various types to take the place of castings.

These industries have employed advertising in the business and engineering papers, have published attractive and cleverly illustrated booklets, have employed engineers and research chemists in various fields to develop their product, develop new markets and, generally, increase the utility of their product.

Their job has been so well done that many engineers and other users have been so thoroughly sold, if not oversold, on products other than castings that many virtues of castings, particularly gray-iron castings, have been obscured.

Analyze for a moment some of the merits of the competitive materials mentioned. Take first the steel stamping. The manufacture of stampings requires an expensive set of dies before a single stamping can be produced. The design and production of these dies consumes a great deal more time than the designing and completion of necessary pattern equipment to make the same part. The cost of the dies is much higher than the cost of the pattern. This point forcibly was illustrated recently when a manufacturer was considering replacing a gray-iron casting by a steel stamping. The pattern equipment made up for quantity production on this particular part cost $208. The dies to make a similar part from stamped steel were estimated to cost $1,425. The manufacturer was informed that any breakage of the die was a matter of customer expense. In case slight changes in design might be necessary to the particular part they could be made much more easily in the pattern equipment than in the dies. In fact, it was doubtful if the old die could be used if any important changes were necessary. Further, the

Suggested Field of Service for Gray Iron Group

Statistics

Compile and disseminate figures on capacities, production, shipments, purchases of materials, etc. Interpret trends from other industrial tabulations.

Research

Study to improve the quality of gray iron castings. Co-operate with existing associations and research organizations. Investigate new manufacturing methods.

Merchandising

Compile uniform trade customs to eliminate misunderstandings with customers, and secure their adoption. Strengthen selling methods and practices.

Development

Expand the old and explore new fields for gray iron castings through market research. Make this information available throughout the foundry industry.

Publicity

Through advertising effort both directly and indirectly acquaint consumers and the general public with the merits of gray iron and protect this product from misrepresentation and unwarranted attack from competing materials.

Organization

Develop sectional groups within the main national body to handle problems of specific importance to the various branches of the gray iron industry.

Acquaintanceship

Stimulate attendance at meetings and promote good feeling among those engaged in the industry to remove the distrust and suspicion of competitors.

Co-operation

Work with the various technical and business ganizations and with various departments of the government to promote the general welfare of American industry.

them dubious in the matter of carrying large inventories. They desire to have cash in the bank in accessible form rather than to carry vast inventories which sometimes are not liquidated easily. This condition which promises to continue has affected the foundry industry.

It has been evident for some years that the foundry industry has been neglecting merchandising. The matter has been called to the attention of the industry at different times and in different ways. It has been pointed out that while quite satisfactory strides have been made in the production of castings through new production methods and new production machines, foundry operation has outstripped the effort to sell the product. New methods of selling have not been employed by the foundry industry as they have in other lines.

Newer industries have been particularly aggressive doing research work to improve the quality and usefulness of their product, and to acquaint the public with their virtues. These industries conducted research along marketing lines developing

manufacturer, after giving thoughtful consideration to the method of producing steel stampings, was of the opinion that the twisting, shearing and stressing action encountered in forming the sheet steel into the desired form would weaken the structure materially. These considerations and the fact that the stamping would not possess the rigidity of a cast-iron part caused the manufacturer to decide to use the castings.

Resisting Rust

There are many other advantages in favor of castings as opposed to sheet steel parts for certain services. A manufacturer of gasoline service pumps decided to use a pressed steel part to supplant a gray iron section. After a comparatively small number of pumps with the newer pressed steel fitting were sent out to the trade it was said that the pressed steel part was corroded and rusted quickly. This caused a return to the cast-iron part.

A similar experience is recorded in the use of pressed steel in the construction of lamp posts. One of the suburbs of Chicago ordered lamp posts of this construction only to find after a time that corrosion was playing havoc with the steel portions of the post. This city returned to cast-iron posts because of the fact that cast iron satisfactorily resisted corrosion.

Many of the objections stated against the steel stamping mentioned are equally applicable to forgings.

The manufacturers of welding equipment have been aggressive recently in pushing welded assemblies. In fact, the propaganda of one manufacturer has been successful to the point of securing the backing of what is possibly the outstanding engineering organization of this country in assisting them to carry on their campaign for welding against casting.

Often the proponent of welding neglects to mention that before welded sections can be employed, it is necessary to install rolling or forming machinery to shape the various standard steel parts to the form desired so that they can be welded into somewhat near the finished part desired. In many cases it is necessary to install new machine tools or new jigs and fixtures to handle the new production, and the resulting product often is only an approximation of the structure desired.

The welding interests advocated the abandonment of rivetted joints in the erection of structural steel, offering alleged savings through the use of welded joints. A prominent construction engineer arises to proclaim that a careful investigation indicates to him that rivetting structural steel in place is still by far the most economical method. A recent article in one of the technical papers also indicates that the matter of training workmen to secure satisfactory welded joints is by no means simple. Skill is required in this line of work as well as in other lines, and supervision and inspection is difficult.

There may be many places where the employment of stampings, forgings or welded sections will answer the purpose as well as castings. For anyone to say that such is not the case is incorrect. The point that it is desired to stress in this article is that the organizations described above have given considerable time and spent much money developing markets for their products, while the casting manufacturer is sitting idly by and is saying nothing about the merits of castings. This is particularly true of the gray-iron industry. The malleable foundries and the manufacturers of steel castings have given some thought to the improvement of the services of their products and telling the consumer public about them.

Complacent Contentment

The gray iron casting manufacturers have done nothing. Available figures will indicate that outside competition has taken considerable business from the gray iron industry. In approximately the last quarter century, the population of the country has increased almost 50 per cent. The output of pig iron in this period has increased 125 per cent. The output of gray iron castings as approximated by the tonnage of foundry iron has not shown anything like the increase that should be indicated in view of the increased population. Therefore, it is evident that the gray iron foundry industry is losing business to other industries.

The regrettable feature is that those engaged in and operating foundries do not seem to be the least concerned with their condition. Gray iron foundry operators must be aroused to the necessity for concerted action. They cannot sit idly by and feel that their markets are going to return. They must join forces and do some real work along various lines to restore their markets.

On every hand concrete evidence is found of the desirability of group action. Some few years ago, the street railway companies of the country were confronted by the serious loss of revenue through the introduction of the privately owned automobile, the jitney bus and other modes of transportation. The street railway companies organized into a national body and started out to retrieve some of the lost ground. The result is that today their campaign to sell street car rides is bringing highly satisfactory results and the effort has saved many a street railway company from the bankruptcy courts.

Other industries have had similar experiences . Among these might be mentioned the paper-making industry in its various branches, California fruit growers, producers of copper and brass products, the cement industry, the paving brick makers and scores of others.

There is need for a national association of gray-iron casting producers. Much constructive work can be accomplished through such a body. The problem is entirely too large for any single company to handle and in this association age the group idea offers a most satisfactory means to the desired end.

Let us consider for a few moments some of the problems which such a nation-wide body would be able to solve.

The important subject of conducting research to improve the quality of gray iron castings is something that should be undertaken. In handling this research, the data available and the co-operation of existing organizations, particularly the American Foundrymen's association, should be utilized to the fullest extent. As a matter of fact, if all of the available information pertaining to the subject of cast iron manufacture was made available it would surprise many. In handling special research problems of an unusual nature it might be possible to work out some such plan as was employed by the Hide Tanner's council of the country. This organization has been working with the University of Cincinnati, Cincinnati, for a number of years with satisfactory results. So valuable has this work proved that the tanners council has erected at its own expense a building on the campus at the university. This building is devoted exclusively to research problems affecting the treatment and handling of hides.

Expanding Markets

Strengthening old and developing new markets for cast-iron products would be a most important function of such an organization. Nothing is being done in an organized way by iron foundries of this country to acquaint industry with the merits of

(*Concluded on Page* 901)

Uses Direct Metal for Ingot Molds

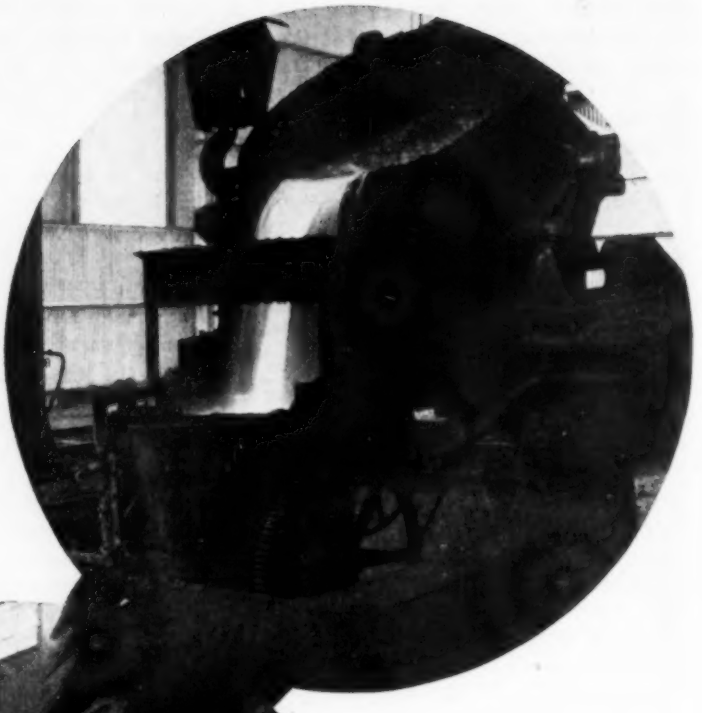


Fig. 1—Above—Direct Metal from 40-ton Blast Furnace Ladle Is Transferred to 15-ton Foundry Ladle. Fig. 2—Left—Tops of the Molds Come Flush with Pouring Platform

CLOSE relationship exists between the process of rolling steel and the style of ingot mold into which the molten metal is poured. The size, shape, thickness of metal and the manner in which it is proportioned in the walls and corners constitute major factors in the active life of the mold and in the character of the steel product rolled from the ingot. Molds are made in an almost infinite variety of sizes and shapes to meet the constantly more exacting demands of the rolling mill where earnest effort is devoted to reduction in crop ends, also reduction in the time required to break down the ingot in the bloom mill.

Split molds as the name implies are cast in two parts. The joint faces on opposite diagonal corners later are planed and fitted with male and female joints. This type of mold usually is comparatively small and is employed in the production of special alloy steel. One end is closed and the two halves are held together with removable steel bands and wedges. Gathman molds, named after the inventor are designed to be used with the small end down and with an auxiliary chamber known as a *hot-top* on the upper or large end to counteract the natural shrinkage and piping.

In all ingot mold foundries the greatest tonnage of metal is poured into a type of ingot mold which may be regarded as standard in general characteristics, although it may vary to a considerable extent in individual size and shape. This mold is tapered from top to bottom, it is open at both ends, designed to rest upon a cast iron stool and is filled with steel through the upper or small end. Usually it is equipped with a steel loop near the center of one side, two cast iron lugs at opposite sides of the top and two upright steel loops in the same vicinity. These loops and lugs facilitate handling in the foundry and later in the steel mills where the molds are employed to receive the molten steel.

Many molds are nearly square in cross section. Steel to be rolled into slabs usually is poured into a rectangular mold, much wider in one direction than it is in the other. Steel intended for certain forging operations is poured into a mold circular in cross section and corrugated vertically on the interior to form a fluted ingot.

Rolling mill operators are familiar with the fact that certain defects in rolled products are traceable to the shape of the ingot, which in turn is dependent upon the internal contour of the ingot mold. Close co-operation is essential between steel makers and manufacturers of ingot molds. Molds today are made with a more accurate regard for the steel maker's requirements than molds made in the past. Bessemer iron either cupola melted or direct from the blast furnace is used exclusively for the production of this class of castings.

Specialization in design and production of ingot mold castings is displayed prominently at the new plant

of the Valley Mould & Iron Corp., located on a 15-acre site on the outskirts of Hubbard, O. This is the second plant designed specifically for the production of ingot molds and stools which the corporation has built within the past two years. The first is located near the Federal stacks of the By-Products Coke Corp., east 108th street and the Calumet river, Chicago. The Hubbard plant occupies a site about 1500 feet from two stacks of the Youngstown Sheet & Tube Co., which supply the direct metal for pouring the castings.

The main building 80 x 990 feet is laid out to facilitate straight line production. Commencing with the cores at one end of the building, the sequence of operation is carried logically through core ramming, blacking and drying; cheek ramming, blacking and drying; assembling, pouring, stripping, annealing and poking out; chipping; to the opposite end of the building where the castings are shipped.

Flasks and other equipment are stored and prepared for use in a building 70 x 240 feet adjoining the main building on the west and with a continuation of the same north wall. A somewhat similar building 70 x 350 feet, but without the monitor roof, adjoins the main building on the east and houses the sand storage bins and the sand preparation equipment.

Stools and other miscellaneous castings including new and repair parts for flasks, seats and core arbors are made in a building 70 x 241 feet located on the east side of the main building and a short distance south of the sand storage building. This building is equipped with a tractor type molding machine made by the Beardsley & Piper Co., Chicago, which

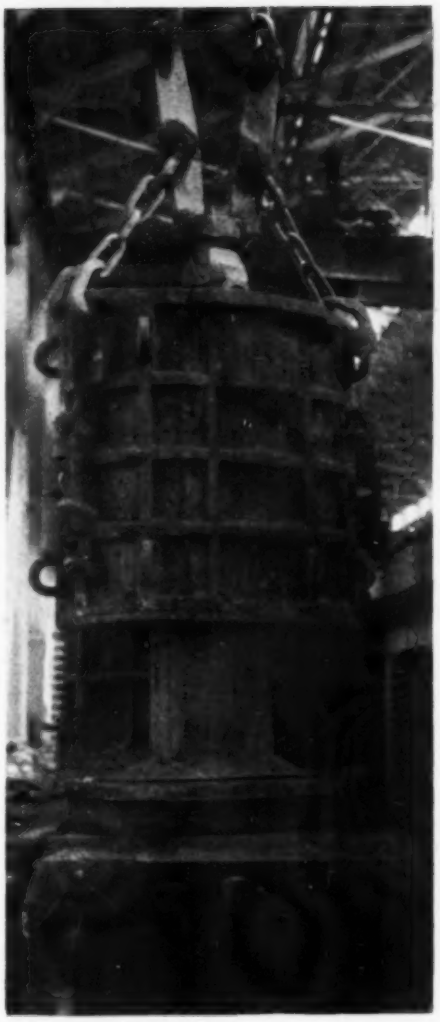


Fig. 3—Special Device strips Mold and Flask From Core

throws sand into the flasks at high speed. The machine operates alternately on two tracks extending longitudinally side by side on the foundry floor from one end of the building almost to the opposite end. The building is served by an overhead traveling crane which lifts the flasks and molds. Also lifts the machine from one track to the other. The general features of this foundry building are shown in Figs. 6 and 7.

All the buildings are of steel frame construction, covered with corrugated sheets and amply lighted through three continuous rows of windows, one row a few feet from the floor, a second row close to the eaves and a third row in the monitor roof. The window sash is designed to swing in the center to promote ventilation.

Ladles are skulled, repaired, relined and dried in a runway 50 feet in width between the green sand foundry and the sand preparation building. The runway is spanned by an electric traveling crane equipped with a magnet in addition to the regular bails and slings employed in handling the ladles.

Sand Is Mixed

New sand is shunted upon a trestle 190 feet in length extending along the inside of the east wall of the sand storage building. Here it is dumped and later transferred by crane and grab bucket to the mixing machinery shown in Fig. 10. Used sand from the shakeout station in the main building is transported to the sand storage building in a carrier suspended from a monorail.

A coarse grade of sand is employed for making both molds and cores and the relative amount of old and new sand in the mixture depends to a considerable extent on the shape of the ingot mold or core, the thickness of metal in the wall of the casting and the total weight. In extreme in-

Fig. 4—Ingot Mold Castings Are Laid Horizontally on a Permanent Skidway for the Convenience of the Chippers Armed with Pneumatic Chisels

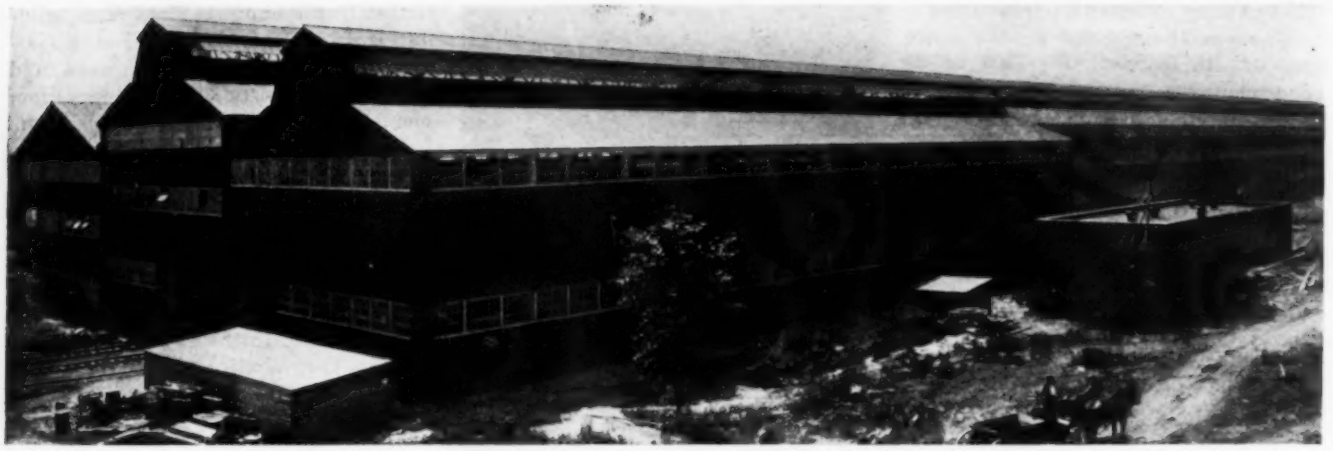


Fig. 5—General View of the Exterior of the Three Main Buildings from the West Side

stances new sand is employed exclusively, but in the great majority of cases the sand for both cores and molds is mixed 50-50, that is 50 per cent new sand and 50 per cent sand returned from the shakeout.

Sand removed from molds at the shakeout station is lifted by a clam shell bucket and deposited on a steel bar screen through which it falls on to a rotary feeder in the bottom of a hopper. The screen catches gates and other scrap. From the hopper the sand is fed into a conical screen with ½-inch mesh. Tailings from the large end of the screen pass through a chute to a belt conveyor equipped with a magnetic head pulley which removes the scrap and loads the scrap iron and refuse sand into separate buckets. Cleaned sand falls through a chute into a pit containing a bucket. The loaded bucket is carried by a 5-ton monorail crane to the main sand preparation building.

An overhead crane in this building picks up the bucket and dumps the sand into an elevated steel hopper shown in Fig. 10. A proper proportion of new sand also is dumped into the hopper and the combination passes first through a rotary feeder into a revolving conical screen and then into an 8-foot diameter revolving drum fitted with deflector blades which effect a thorough mixture of the sand. A certain amount of the sand designed for the cores is given further treatment. It is dumped into the nearer of the two hoppers shown in Fig. 10 and then into a muller made by the National Engineering Co., Chicago.

Only the steel columns supporting the roof, separate various adjoining buildings and this arrangement facilitates the transfer of sand from the sand preparation building to the ramming stations for the cores and molds located on the east side of the main bay. Prepared sand lifted by the crane is dropped on a slanting apron between the columns which guide it upon the platforms where the rammers are stationed.

Core barrels are made according to several different patterns, including the solid or one-piece type and the so-called collapsible type in which four loose plates are assembled

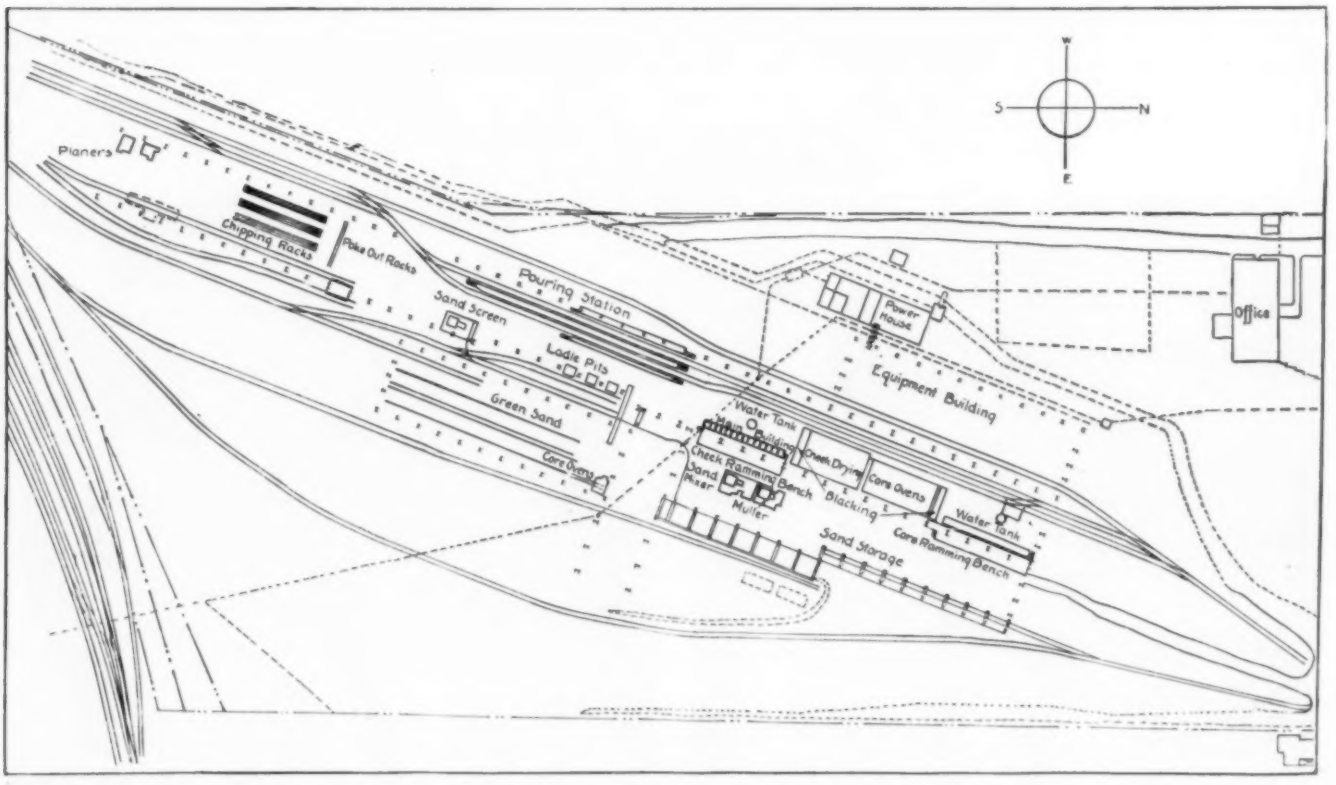


Fig. 6—General Layout of the Ingot Mold Plant Showing the Relative Position of the Various Buildings

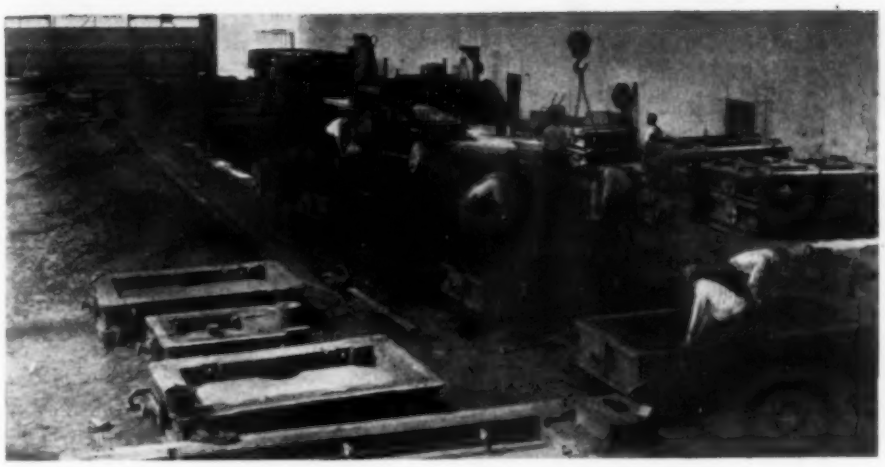


Fig. 7—Stools Are Cast in Open Green Sand Molds

around a central standard. Each type presents certain advantages and disadvantages. For example the one piece type involves the lowest initial expense, but involves a little more work and time in stripping the casting. Theoretically the collapsible barrel provides greater freedom of contraction for the casting, but for all practical purposes the ingot molds poured around one piece cores seem to give eminent satisfaction.

Unanimity of opinion does not prevail on this point. Mill men are divided into two schools. One holds that complete and natural contraction does not take place unless a collapsible core barrel is employed. The second school claims that the thickness of sand around a one piece core yields sufficiently to take up all the contraction. The foundryman has his own opinion and will give it to the customer if the customer wants it. Otherwise he takes the customer's order and makes the mold to suit him, with either a one piece or a collapsible core barrel.

The base of the core barrel whether cast integral or bolted to the shaft, is fitted on the four edges with tapered strips designed to guide the core into its print, first in the corebox and later in the base of the mold. The barrel is pierced with numerous vent holes to facilitate the escape of steam and gas, first in the oven and later when the core is surrounded with molten iron. Hot barrels are dipped into a water tank before they are used and cold barrels also are dipped to insure a more even spread of the claywash with which they are coated before they are placed in the corebox. Frequently under press of conditions the corebarrels must be knocked out of the hot castings and returned immediately to the core ramming station.

Coreboxes for the standard sizes are formed of cast iron. The box is split in two vertically along diagonally opposite corners. The halves are hinged along one parting line and are held together on the opposite side by two or three latches and cams. Castors on the bottom support the weight and facilitate opening and closing the two halves of the corebox.

A special eye-bolt with a T-head which is dropped through an opening in the top of the core barrel and given a half turn, is employed for lifting the core barrels into and out of the corebox. Also on almost every other occasion when the barrels or cores are to be moved from one place to another. After the core barrel is placed in the seat the corebox is closed and rammed full of sand with pneumatic rammers equipped with extension shafts and suspended from counterweighted cords. Average thickness of sand around the barrel is 2 inches. One man shovels sand steadily into the corebox while a second man manipulates the rammer.

Fig. 9—Cores Are Rammed at the Bench Shown to the Left and Dried in the Oven Shown in the Right Background

Fig. 8—The Cheek Ramming Bench Is Supplied with Sand from the Adjoining Department

After the sand has been rammed up to the neck of the barrel, the corebox is opened. The core is picked up by the crane and suspended by the neck over a long trough where it is given a coat of blacking. When a number of cores have accumulated they are lifted from the rack and then lowered into a large oil fired oven with a holding capacity of 40 average size cores. The cores do not rest on the bottom but are suspended by short steel bars which pass through the necks and engage the upper side of pairs of parallel rails extending from side to side of the oven. The

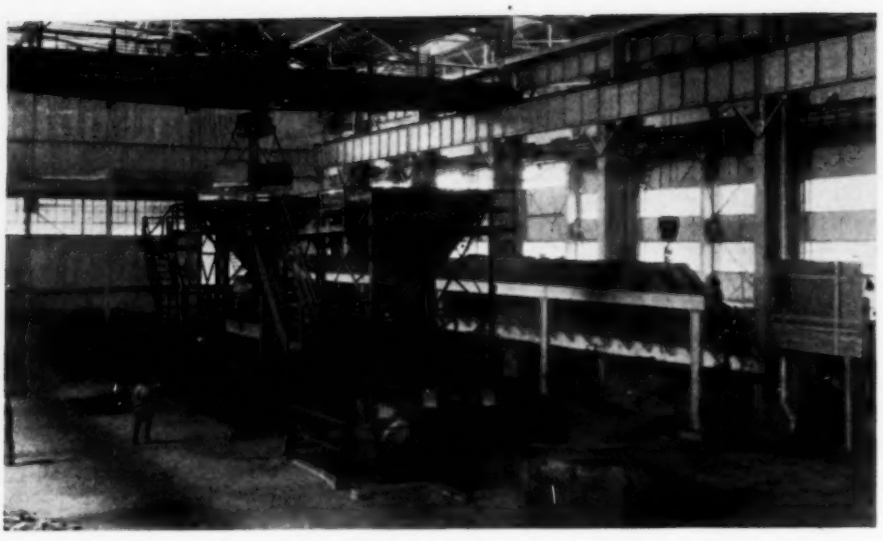


Fig. 10—Two Mixing Units Are Provided for Preparing the Sand for the Cheeks and Cores

top of the oven is closed with flat steel doors mounted on roller bearings.

Temperature of the oven is maintained between 550 and 600 degrees Fahr., a temperature which effectually dries the cores in between 3 and 4 hours. All cores are not alike. The dried cores are removed from the oven and lowered into place in a row of bases arranged in a line in front of the ramming benches. The bases are mounted on cars and after the cheeks have been lowered over the cores the cars are shunted to one of the two parallel pouring platforms located farther along toward the south of the main building.

Heavy cast iron flasks employed in the ingot mold foundry are split vertically in the center of opposite sides and are provided with suitable pins and pin holes on the joint faces. They are readily assembled and just as readily taken apart to facilitate shaking out the castings. Each section of the flask is fitted with one or two steel loops by which it readily may be handled by the crane.

Outside Runner

The flask is assembled while in a horizontal position, then swung upright and lowered over the wood or iron pattern standing on a base provided with guide pins for locating the cheek flask. A thin steel stripping plate also reposes on the base. It is clamped to the lower flange of the cheek flask and insures a clean lift. It is released after the cheek has been lifted about a foot from the base and drops back to place. The usual generous taper on the outside of the pattern gives sufficient clearance for the cheek on the remainder of the distance to the top.

Pneumatic rammers equipped with extension shafts and suspended from a light counter-weighted rope are employed for ramming the sand in the cheeks. Usually two men ram the sand in each mold, while a third man shovels sand into the flask from a pile on the platform, constantly replenished from the sand mixing department adjoining.

A length of 2-inch pipe is rammed in a pocket provided for the purpose in one side of the flask. After the flask is filled with sand the pipe is removed and leaves an opening through which the molten iron is conducted to a gate at the bottom of the mold. This gate is cut after the cheek has been lifted from the pattern and placed on a trestle where any imperfections are repaired and where the surface is blacked with a long-handled mop. Blacking on the cores is finished with the trowel and slicked with a fine brush, but the blacking on the outside surface is not touched after it has been applied.

Molds are lifted from the blacking station and placed on a nearby drying platform equipped with 20 oil torches arranged in four rows with five burners in each line. Each mold is placed over an individual burner where the sand lining of the flask is dried in two or three hours. The top of each mold is covered temporarily with a light sheet and most of the steam in the sand is driven through the vent holes with which each flask section is liberally provided. The dried cheeks are lifted from the drying station and lowered over the cores in the manner referred to previously. The assembled molds gradually accumulate at the pouring platform, between the arrival of successive supplies of hot metal from the blast furnace. The furnaces tap on a 4-hour schedule day and night, therefore a supply of molds must be provided at all times to receive the iron. At night, on Sunday and on other usual shut-down periods, the iron is converted into pigs at the furnace.

Iron From Blast Furnace

The casting platform is located near the center of the main building a short distance south of the space occupied by the core and cheek making sections and separated by the width of the two railroad tracks from the building in which stools and other castings are made in green sand molds. Hot metal is brought in on these tracks in 40-ton ladles. Each ladle is picked up by a crane and the contents poured into a 15-ton, bottom-pour foundry ladle employed to pour the molds. Three of these foundry ladles are kept in readiness in three pits close to the point where the blast furnace ladles terminate their journey in the foundry.

Stoppers for these ladles are dried in a small oven and in practically every particular are prepared and used as in steel foundry practice. The only particular in which they differ to a marked extent is that one stopper may be used a great many times, in-

Fig. 11—Jackets, Core Arbors and Bases for a Wide Variety of Sizes Are Kept in the Equipment Building

stead of only once as when steel is handled in a ladle. Runner cups on the molds drain out clean and in that manner also are eligible for use several times before erosion impairs their usefulness.

Assembled molds are mounted on a train of buggies and lined up in front of the pouring station. Usually the cranemen spot the nozzle of the ladle over each runner cup in succession, but if for any reason this program is interrupted, an electric locomotive is available to push the molds under the ladle, one after another. The same locomotive is employed to shunt the molds away from the platform to the shakeout station, where the molds and flasks are lifted to the floor by a crane and the buggies returned to the vicinity of the drying ovens for a new load of cores and cheeks. Bases remain on the buggies.

Molds are allowed to lie undisturbed for four hours before the flasks are stripped from around them. The flasks are reassembled and returned to the ramming station or to the equipment building, depending on whether or not they are needed immediately. The sand falls through a screen and is returned to the sand preparation department in a bucket suspended from a monorail hoist. Lumps and other debris are shoveled into a chute which discharges into a railroad car on the outside of the building.

Remove Core Sand

From the shakeout station the castings are taken to the poke out racks where the core sand is removed. Then they are lifted upon the shipping racks where any necessary trimming is done with pneumatic chisels. Certain types of ingots must be planed at one or both ends. Special circular cutting machines designed for the purpose are located near the south end of the building to finish molds in this manner. From this point the castings are loaded into railroad cars spotted in turn on a track scale which determines and records the weight of the castings.

Lockers and sanitary equipment, storeroom and power house are located in a separate brick building to the west of the main building. Power for operating and lighting the plant is generated at the Hubbard plant of the Youngstown Sheet & Tube Co., and transformed from alternating to direct current at the local plant of the Valley Mould & Iron Corp. The first column of the present plant was erected March 21, 1927, and active operation commenced June 22.

Fig. 12—Trains of Molds Are Shifted by an Electric Locomotive

Making Cores in the Dodge Foundry

(*Concluded from Page* 878)

rows of ports. One row is near to the bottom and the other near the top. The upper and lower ducts are connected by pipes running down on the outside of the oven, and fans suck the hot gases from the top of the oven into the pipes and force it back again at the bottom. In this way recirculation of the hot air and uniform distribution of heat is maintained.

The open flames of the burners are hooded partially, which helps in the distribution of the heat. Products of combustion are exhausted through a stack equipped with a motor driven fan. The capacity of this core making department is 250 tons of cores in a day requiring from five to six carloads of sand. This unit is entirely automatic as to temperature control and baking time.

A pattern shop is maintained on the fourth floor, which is equipped fully with metal and woodworking machinery necessary to the making of metal and wooden patterns, etc.

Fully equipped machine and blacksmith shop for foundry repairs are located on the fifth floor. Here repairs are made to any and all machinery and equipment used in and about the foundry, as well as some other parts of the plant. The machines for straightening, bending and cutting the wires for strengthening the cores are also located on that floor. One section is set apart for pattern storage.

The sixth floor is a brass and aluminum foundry. Here are ten of the in-and-out type of core baking ovens which are 12 feet long and six feet square. These are gas fired, and small parts of cores are baked by stacking in racks and running the racks directly into the ovens.

One innovation in the Dodge Brothers foundry is a method by which cylinder block castings are made entirely with dried cores, no green sand coming in contact with the casting. While the flasks are lined with green sand this lining is covered completely with the dried cores when they are assembled, so that no molten metal ever comes in contact with it. By making up the flasks in this fashion losses are kept very low.

Will Enlarge Departments

Cramp Brass & Iron Foundries Co., Philadelphia, has plans underway for an enlargement of its nonferrous and electric furnace divisions and already has increased its sales personnel. The company is engaged in the production of electric furnace and gray iron castings and nonferrous castings. The firm originally was the foundry department of the William Cramp & Sons Ship & Engine Building Co., and was incorporated as a separate entity in April, 1927. Officers of the present firm are H. Birchard Taylor, president; C. C. James, treasurer; William D. Ward, vice president, and Herbert Cramp, secretary. N. H. Schwenk is manager of foundries.

Convention To Be Held

The American Vocational association will hold its second annual convention in Los Angeles, on Dec. 17, 19, and 20. The organization is the amalgamation of the Vocational Education association of the Middle West and the National Society for Vocational Education and represents those interested in trade and industrial education, home economics education, manual arts education, foreman training, vocational rehabilitation and vocational guidance.

Simplify Foundry Sand Tests

Equipment Is Inexpensive and Compact—Sand Specifications for the Different Molding Floors Are Determined by Experiment

By T. F. Kiley and T. W. Peterson

DECISION to test molding sand by the compression method was reached after seeing experiments carried on at the laboratories of Saunders & Franklin, Providence, R. I. The apparatus described was designed and to some extent constructed by the Brown & Sharpe Manufacturing Co., and has been employed to control foundry sands in that plant for over a year. It fits in well with the standard American Foundrymen's association ramming and permeability apparatus. Tests for relative moisture, permeability and bond by compressive strength of a standard 2-inch core, are run on one rammed sample. The compression unit readily may be constructed by any foundry associated with a machine shop.

Fig. 2 shows a green sand core on which the compressive test has been made for bond. Loose sand remaining on sides after compression has been removed, leaving top and bottom of core practically intact and in the shape of a double cone, indicate the pressure was applied uniformly, thus giving the ideal test. The double cone is not so evident on cores of strongly bonded sands. Scale recoil on completion of the test causes the core to fly apart to a greater extent.

Sand is weighed on the small scale *E* Fig. 1. This scale is accurate and has been equipped with a scoop for placing sand in the tube of the permeability apparatus *F*, Fig. 1 without spilling.

Daily and Weekly Tests

Specifications according to the accompanying table have been adopted at the foundries of the Brown & Sharpe Manufacturing Co., for sand for the different molding floors. Each molder's heap is tested at least once a week. Reclaimed and facing sand prepared in a mixer of the muller type is tested daily. The moisture indicator *C* Fig. 1 made by H. W. Dietert, Detroit is attached to the ramming device to show relative moisture content. The weight of sand used for any particular floor is such that an average sample will fall at about 5 on the indicator. If a sample exceeds specifications on moisture or falls below, this result is recorded, but permeability and bond tests are run only on samples within specified moisture limits. Where the sample is too wet it is dried to bring it within the required limit. Where it is too dry, the necessary amount of moisture is added.

Compressive strength is figured in pounds per square inch, by dividing the crushing load registered on the scale by 3.1416. Specifications on compressive strength in the table were arrived at from observations showing strengths that would give the best molding results from various floors. Likewise with relative moisture and permeability.

After determining relative moisture and permeability, the core is pushed out of the tube by the rammer, on to a round steel disk *X* Fig. 2. A slotted fixture *B* Fig. 1 is inserted in the top of the tube to insure an even draw. The rammer weight *G* Fig. 1 is held back with one hand while the rammer head is forced down until flush with the sand core. The rammer then is held stationary and the tube raised by leaving core on the steel disk.

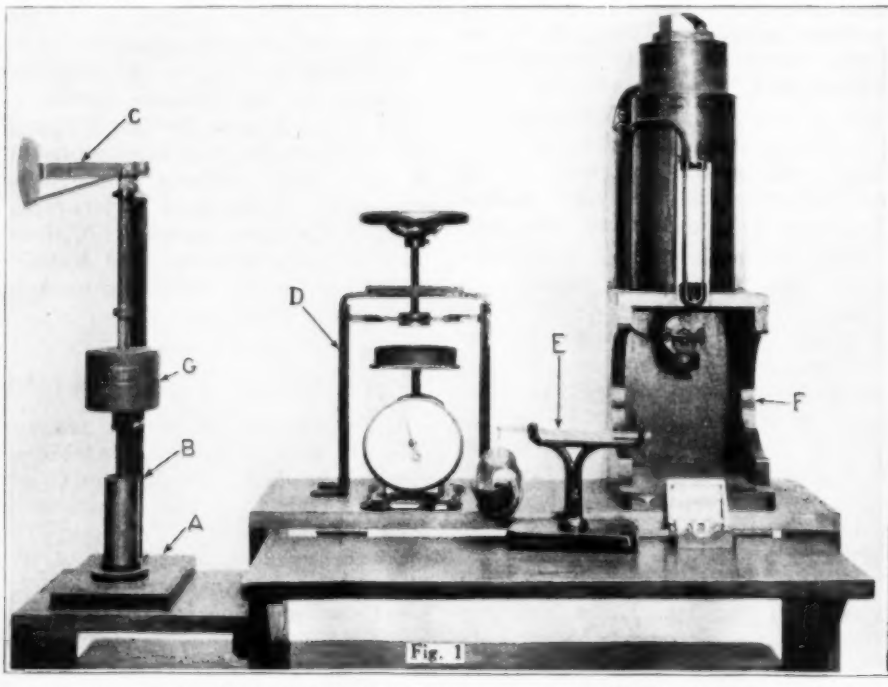


Fig. 1

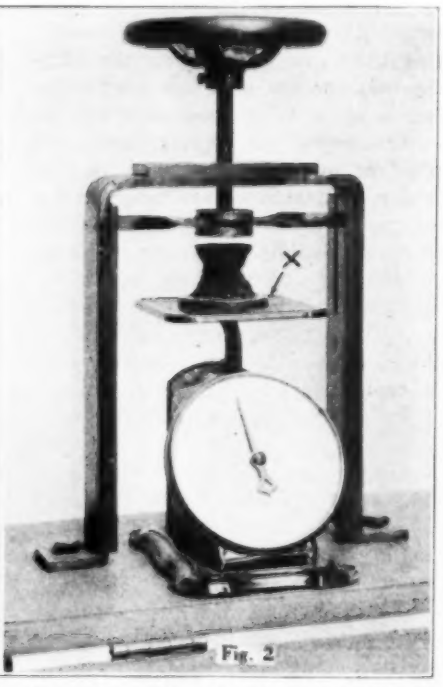


Fig. 2

FIGS. 1 AND 2—COMPACT ASSEMBLY OF PIECES OF EQUIPMENT REQUIRED FOR ROUTINE SAND CONTROL IN THE FOUNDRY. THE SPECIAL COMPRESSION DEVICE MADE IN THE PLANT AND SHOWN IN THE CENTER FIG. 1 AND TO THE RIGHT IN FIG. 2 SUPPLEMENTS THE OTHER PIECES OF SAND TESTING EQUIPMENT ADOPTED AS STANDARD BY THE AMERICAN FOUNDRYMEN'S ASSOCIATION

The scale used for registering the load to compress the core is of the type known as a family scale. It is inexpensive and accurate enough for all practical purposes. Further refinement that might be of service would be to have a scale equipped with a double pointer which would register maximum load when the core crushed thus doing away with the necessity of watching the scale closely to catch this reading. Also it would be an advantage if the scale registered pounds per square inch as well as load to compress the core. This would save time in calculating compressive strength in pounds per square inch.

Specifications for Foundry Sands

Floor	Weight, grams	At moisture Fig.	Bond Lbs. per sq. in.	Permeability
Light foundry, reclaimed	175	5.0-6.0	4.0-6.0	12.0-18.0
Squeezer	160	4.0-6.0	3.0-5.0	6.0-12.0
Machine	175	3.5-5.5	3.5-5.5	13.0-25.0
Side	175	3.5-5.5	3.5-5.5	18.0-25.0
Crane	175	3.5-5.5	3.5-5.5	20.0-35.0
Facing	175	3.5-5.5	4.5-6.5	20.0-35.0
Light foundry, reclaimed	175	4.0-6.0	4.0-6.0	12.0-18.0
00 Albany	155	5.0-5.6	3.0-4.5	6.0-12.0
0 Albany	160	4.5-5.0	3.0-4.5	12.0-16.0
Medium molding	180	3.0-4.0	4.0-5.0	25.0-40.0
Red Key	185	3.0-4.0	3.0-5.0	35.0-50.0
Jersey Green	190	2.5-3.5	3.0-5.0	80.0-125.0

Window Weights Are Made in Permanent Molds

Question: I will appreciate any information you can give me regarding the manufacture of sash weights on an extensive scale. How to make sash weights in permanent molds. Also how to make the molds. Some time ago I read an article on this subject in THE FOUNDRY but at present cannot trace it.

Answer: If you have not a complete back file of your own, you probably will find one in your city public library. The article to which you refer may be the one which appeared in the Oct. 15 1925 issue describing a revolving type permanent sash weight mold made by a firm in this country. An extensive series of articles relating to the making of sash weights has appeared in THE FOUNDRY from time to time over a period of several years. For example you will find reference to the subject in seven consecutive articles treating on practically every method for making these castings which appeared in THE FOUNDRY from March 15 to June 15, 1924, inclusive. Additional shorter articles on the same subject were published in the issues of March 1, April 15, Sept. 15 and Oct. 15 of the same year. During 1925 the subject was taken up in the issues of May 15, Aug. 1, Oct. 15 and Nov. 1.

In the June 15 and July 1, 1924 issues of THE FOUNDRY we published a paper in two parts by Robert G. Anderson and M. Edward Boyd on the subject of permanent molds. This paper was prepared as the annual American exchange paper to be presented at the meeting of the Institute of British Foundrymen, held at Newcastle-on-Tyne, June 4, 1924.

In addition to describing many features of the permanent mold development from its first inception, the paper forms a comprehensive bibliography showing practically a complete list of all the literature published on the subject up to that time.

A symposium of views on permanent molds was presented at the Detroit convention of the American Foundrymen's association, Sept. 29-Oct. 3, 1926. These papers are incorporated in the *Transactions* of the association. Also they were published in the May 1 1926, issue of THE FOUNDRY. Four papers by H. A. Schwartz who has done a great deal of work on oil cooled molds, were published in THE FOUNDRY in Jan. 15, Feb. 15 and March 1 1926. From the foregoing it is apparent that a casual description of permanent molds is entirely beyond the bounds of the space at our disposal.

Sash weights are made in many ways depending principally on the volume of business. Small and medium quantities are made extensively from solid patterns sunk half way in a follow board. With a squeezer or jolt machine, split patterns may be mounted on both sides of a matchplate. In several plants the patterns are mounted vertically on jolt machines. The patterns are stripped through a plate and the eye in each one is formed by a short core. The length of the casting is determined by the distance the pattern is allowed to project through the plate.

In another method also practiced extensively, two rows of patterns are rammed alternately above each other horizontally in a deep flask and are pulled through suitable openings in one end of the flask. The open ends are stopped by small plug cores or chills to form the eye in the casting. The metal enters the mold through a small gate which is located at the upper end.

Pittsburgh Trains Apprentices

By Dr. C. B. Connelley

This article is abstracted from a paper presented at the Chicago convention of the American Foundrymen's association. Dr. Connelley is director of industrial relations, Carnegie Institute of Technology, Pittsburgh.

IN THE Pittsburgh district foundry apprentice work is meeting with the approval of the foundrymen; so much so, that the local apprenticeship committee is compiling a bulletin "Why the Foundry Industry," considerable space is given to work of the American Foundrymen's association, especially the apprentice training program sponsored by that body.

Our local association at Pittsburgh had as guests at a recent meeting all the apprentices receiving the foundry training that is fostered by our committee in the public school system. This was prompted by a story from Mr. Hartley, director of education, National Founders' association in which he made these statements:

"Since restricted immigration has forced employers to recognize the public schools as an original source of labor supply, employers are justified in inspecting the schools with a view to offering suggestions regarding the effect of schools upon industry. As long as an industry could look to foreign countries to furnish the great bulk of its labor, it could afford to view public school activities in a detached manner. When an industry is forced by circumstances to depend upon the product of these schools, some attention must be given to the quality of the school product.

In the nature of things, another generation will find our industries being operated and, to a considerable extent, managed by persons who began their training in our public schools. By this time many present employers will have earned the right to enjoy the belated fruits of their labors. These industrial leaders are now interested, as a matter of protection, in character of youth the public schools are preparing to send to factories.

"Of one thing employers are quite certain. It is vastly more important that young men who come to industry are willing to work than that they are able to read Latin or even to perform difficult mathematical calculations. Technical information, althought of great value, is much less important than a wholesome attitude toward work and social obligations. This is exactly the point of interest employers are beginning to manifest in public school instruction. Many national leaders, parents, and even school men, are beginning to ask if there is not something wrong with a school system whose chief aim seems to be to train our children away from work instead of training them into useful service in occupations."

Develops Courses

The Pittsburgh Foundry association met and agreed to follow this thought and took up the work with the board of education by developing classes in the Pittsburgh schools. Mr. Levitt, the associate superintendent, has sent to me the following report:

"In developing a number of varied trade courses in the vocational or trade schools of the Pittsburgh public school system, due consideration has been given to the necessary co-operation of the particular industry involved. Until the industry itself decides that a trade course or trade courses would be of value to the industry, the school system has withheld experimentation. For the above reason, little has been done with foundry work until the present year. The industry itself has not been of the opinion that the time was ripe for public school classes in this kind of work. This opinion has been due largely to the fact that the Carnegie Institute of Technology has been doing such excellent work in this field.

"In 1926 the Pittsburgh Foundrymen's association, after several meetings had been held for discussing the question, came to the conclusion that there was a place in the old scheme of education for foundry work which could not be filled by the Carnegie Institute of Technology, but which could be filled properly by the public school system. Various committees have been appointed by the Pittsburgh Foundrymen's association to help in developing the work of foundry apprentice training in the following particulars:

"First, there was a committee appointed to write to the board of education requesting that the board give careful consideration to the needs of training a certain number of boys in the trade school for jobs as molders' apprentices.

"Another committee was appointed to co-operate with the school officials in selecting the school plant where, all things considered, it was deemed to be most profitable to start the work experimentally. This committee selected a school plant on the north side, where a small room was available in the Phipp's gymnasium building. This room has been equipped by the board of education with some assistance by

DR. C. B. CONNELLEY

the Pittsburgh Foundrymen's association as adequately as possible, considering the limitations of size. Another committee was appointed to assist in securing apprentices who would enter upon the part-time plan of apprenticeship work or to co-operate with the school officials to this end. Another committee was appointed to co-operate with the schools in developing a satisfactory course of study.

"As the result of the activities of these various committees co-operating with the school officials the Pittsburgh vocational school is operating classes in molding at the present time. The members of these classes are either part-time molders' apprentices or boys regularly enrolled in machine shop classes and trade drafting classes and still others who are taking molding with a view to securing positions later on as part-time molders' apprentices.

"At the present time a new central trade school is being planned and it is intended that adequate provisions shall be made in the new building for such instruction in foundry work as will meet the needs of the industry as seen by the Pittsburgh Foundrymen's association, working through its various committees.

"The Pittsburgh Foundrymen's association has asked and received the co-operation of the Pittsburgh public schools in putting on an essay contest beginning in September, 1927, on the topic of 'Foundry Work as a Life Career.' The association has offered substantial prizes for the winners of this contest and the details are to be worked out by a joint committee representing the Pittsburgh Foundrymen's association and the Pittsburgh public schools."

From all of the above, it will be seen that while little has been done by the Pittsburgh public schools in the field of trade training for foundrymen, we are moving forward and are proceeding along the lines which are sure to take us in the right direction. A considerable expansion of this work is to be expected within the next four or five years, if the foundrymen themselves believe that such expansion is necessary or desirable for the interests of the trade.

The foundrymen are willing that all advancement possible be made and are helping at every point.

Promote Essay Contest

Under the auspices of the Pittsburgh Foundrymen's association and the Pittsburgh board of public education, an essay contest has been arranged for boys 14 years of age or older in the seventh, eighth or ninth grades of the Pittsburgh public schools.

Eight prizes from $5 to $25, aggregating 100, are being offered for the best essays on "The Foundry Industry As a Life Career" which must be presented not later than Jan. 3, 1928. Prior to that time, each contestant must visit one foundry at least one time for the purpose of studying actual foundry practice.

The following is a list of the foundries open to this visitation: Pittsburgh Valve Foundry & Construction Co.; Sterritt-Thomas Foundry Co.; Pittsburgh Malleable Iron Co.; McConway-Torley Co.; Union Steel Casting Co.; United Engineering & Foundry Co. (Frank-Kneeland plant); Mesta Machine Co.; American Steel Foundries (Verona plant); Locomotive Stoker Co.; National Bearing Metal Corp. (Damascus plant); Rosedale Foundry & Machine Co., and the Pressed Steel Car Co.

Gating Is Important in Casting Sound Aluminum

By W. J. Clark

DIFFERENCES of bulk or thickness in the same casting are the cause of much trouble to the molder of aluminum. Those differences in bulk make differences in cooling rate as well as variable contractions and result in the defects common to shrinkage. Gating for running, gating for feeding and chilling the castings are the common means against them. In running castings of variable bulk I always strive to deliver the metal as far from the heavier casting sections as conditions warrant thereby furnishing the relatively colder metal to the heavier zone.

This diminishes the time difference between the cooling of the two sections and relieves the heavier section of its otherwise harder pull. In Fig. 4, a thin rectangular plate with a heavy solid center hub is shown. I would gate and double pour this casting at the extreme ends, forcing the metal getting to the hub to travel, and thereby cool, the longest possible distance to the hub. I then would have colder metal in heavier section and hotter metal in the lighter sections which constitutes the logical order of things.

Were I to gate along the side instead of the end of the casting I would at least cut down on the advantage. By horn gating from under the hub I would not only lose the advantage altogether but set up its opposite as well. It is of course not to be understood that this temperature difference will control shrinkage altogether in the hub since it certainly will not. It is however a contributing factor of no mean consequence.

Describes Practice

All foundrymen realize that the disposition of gate and riser openings in the mold have a great influence on the casting obtained. Chills, both external and internal, sometimes are necessary to prevent draws where thick and thin sections adjoin. In this the second and concluding section of his article on casting aluminum, Mr. Clark describes some methods he has used to obtain sound castings. The first section appeared in the Nov. 1 issue.

In gating bulky aluminum castings of uniform section, such as pin castings at the bottom, an interesting situation arises in that at the finish of pouring the hotter metal is at the bottom whereas all reason would seem to indicate that it should be at the top of the casting. The proposition is perfectly logical though perhaps sometimes overstressed. At any rate I always use large sprues and runner gates in bottom pouring such castings. This gives two advantages, a faster pour and a prolonged upward pressure of the sprue on the casting metal. Naturally the advantage of a placid delivery is lost but in all such cases I aim to float the full surface of the rising metal into a riser in the cope of the mold, thus carrying the surface froth and dross out of the mold altogether.

Gate feeding a casting seems to be a fundamental weakness more or less prominent among molders and many castings I have seen or made, received the penalty. *Where, when* and *how* to feed a casting are logical questions to be answered in practice in a purely logical way. First of all, the nature of the metal or alloy regarding its shrinking tendency has much to do with the problem. The power to resist shrinkage is not the same in all metals and a casting made of one metal or alloy may do well without feeding. That from another metal or alloy would turn out utterly bad.

Many ordinary castings made of phosphor-bronze, for instance, will prove satisfactory without feed, that if made of pure copper, of yellow brass, of aluminum bronze, man-

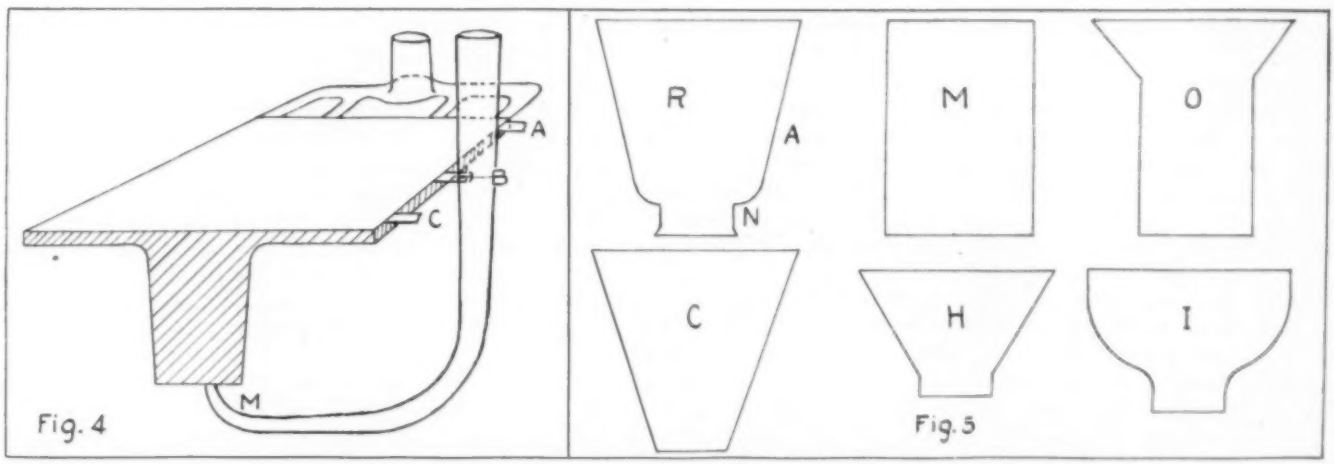


FIG. 4—GATING AT THE EXTREME ENDS OF THE PLATE AND DOUBLE POURING FROM THEM DELIVERS COLDER METAL TO THE HEAVIER HUB. FIG. 5—RISERS OF VARIOUS SHAPES AND SIZES

ganese bronze, gun metal etc. would not get by. To this latter class aluminum and its alloys belong. They simply have to be watched closely and in many cases fed amply against shrinkage.

When and *where* to feed an aluminum casting is a common sense matter to determine. It is manifest wherever bulk is high in the mold, or heavy or is drawn upon by some adjacent casting section not otherwise served. Briefly the proposition is to feed wherever bulk is high, heavy or variable. As a matter of safe practice wherever bulk is at all prominent a gate of substantial volume to feed the casting against shrinkage should be used regardless of the distribution of bulk.

A 6-inch cube will illustrate. It contains 216 cubic inches of metal in compact form and admits no question as to the necessity of heavy feed. A rectangular plate 9 x 12 x 2 inches is less bulky though at the same time sufficiently so to warrant the use of several feeding risers. A similar plate 18 x 24 x ½ inches is distinctly distributive of its bulk and could be ventured safely with ordinary gating feed. In all the above examples it will be noted that volume is the same, that is 216 cubic inches.

Shrinkage often shows up badly where a gate is attached to a casting, and fundamentally is due to erratic size or shape somewhere in the gate. A broad thin gate will set while the casting metal is yet fluid and leave no local effect. A medium size gate may set while the casting metal is solidifying and produce a bad draw. A heavy, bulky gate well backed up will remain open and feed the casting until the casting is completely solid, rendering an ideal result. That in a nutshell is the whole philosophy of cause and remedy of a draw at the gate end.

How to feed a casting is another rather misunderstood detail of practice. From a standpoint of reason any feeding reservoir of a casting should remain amply liquid and in free communication with the casting until after the casting is completely set, and should embody that pressure which will force its content down into the congealing casting-metal. Briefly then a riser should be *high*, *heavy* and *hot*. Of all risers and shapes of risers, I like the bottle neck effect best as illustrated in Fig. 5.

The sound principles of this design are at once plain. *N* is the neck of ample size to remain open while the casting sets. *R*, the reservoir of volume and bulk extends upward to furnish the necessary hydrostatic pressure. The riser is intended for the top of a casting. When used on the side of the casting similar principles of construction can be observed. In Fig. 5 *M*, *O*, *C*, *H* and *I* represent common errors in risers. In *M* bulk is uniform and too small, in *O* neck is too long, in *C* dimensions at casting are too small. In *H* the riser is too short, while in *I* the basin is too shallow. Bulk for bulk the round riser will stay hotter longer and feed better than the square riser.

Chilling heavy metal sections is another means of reducing aluminum shrinkage. It is of two kinds, external chilling and internal chilling. External chilling consists in using sections of iron, copper, carbon, aluminum or some other heat-absorbing materials fitting snugly the contour of the pattern. They are set against the pattern and rammed up with the mold. When the pattern is drawn these metal sections make that part of the mold containing bulk of metal and act as a chill to hasten its freezing.

The chills usually are made from a pattern of plaster paris and shaped to the desired form. In external chilling the effect is from external surfaces inward, driving the effects of shrinkage farther under the surface but not eliminating them altogether. This weakness of the external chilling of metal bulk I have seen in many castings and am convinced that while it is a great help it is by no means a complete cure for shrinkage. Between externally chilling a casting and feeding a casting, the latter is undoubtedly the better and constitutes my own practice where ever possible.

Internal chilling consists in inserting in the mold, pieces of solid similar metal to be consumed by the casting metal at a loss of temperature proportional to the bulk of chill. It is simply a means of cooling the metal in the heavy section to a point where its freezing will be hastened and its shrinkage correspondingly lessened. The chill inserted can be in the nature of aluminum wire, bar or any other convenient form. These are quite easily anchored in the mold and if clean, dry and not too bulky to resist fusion, control shrinkage. No amount of chilling either internal or external is sufficient to eliminate shrinkage in heavy aluminum castings.

Experiments on a six inch cube demonstrated this. The cube was chilled on six sides and gated at the top. Poured simultaneously with an unchilled cube of same dimensions, shrinkage in the chilled cube, though distinctly less than in the unchilled, was still plainly evident. The same casting chilled on five sides and fed through the sixth or cope side with a good riser came solid and weighed 5 ounces more than the chilled casting unfed.

Frequently I have used with good results two separate pouring gates

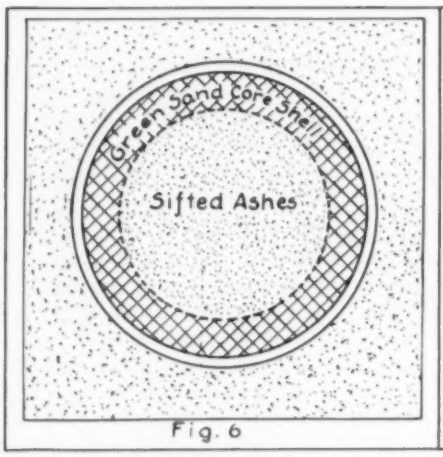


Fig. 6

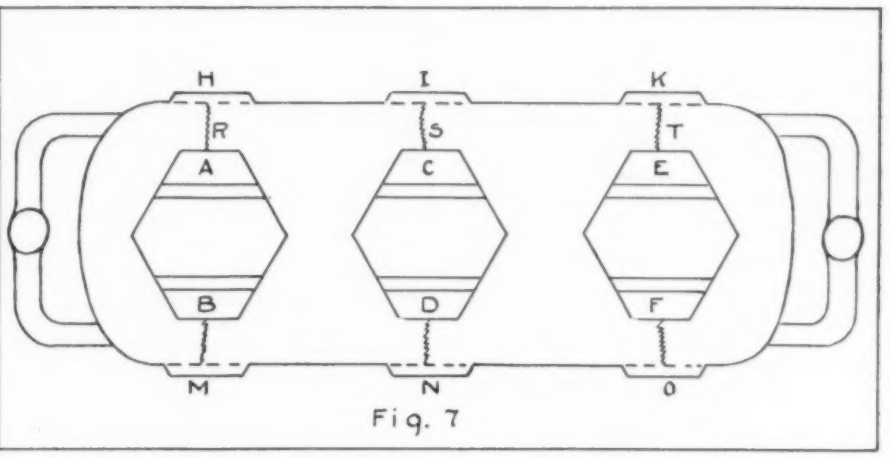


Fig. 7

FIG. 6—GREEN SAND CORE WITH SIFTED ASHES IN CENTER ALLOWS CASTING TO CONTRACT WITHOUT CRACKING. FIG. 7—TIEING GATES AND HEAVY FINS PREVENT CRACKING OF THINNER SECTION ON EDGES OF THE OPENINGS

to assist in controlling shrinkage. One gate delivered cold poured metal to the heavy section, the other delivered hotter metal to the lighter part. The principle of this method will appear later in connection with Fig. 9.

Fundamentally, aluminum castings crack or part in cooling from two distinct causes; first, resistance and, second, difference in cooling rate. The latter makes a difference either in amount of contraction or in strength of metal at different casting points. These two causes when they coincide, increase the effects. Resistance can come from hard sand either dry or green, from sprues or from the friction of sand surfaces bearing on the metal as it solidifies. Often a hard dry core will not give enough to satisfy the metal and the casting cracks. Likewise a green core, where the quantity of contraction is high as in a ring casting 40 inches outside diameter and 1½ inches square section.

Core Is Too Strong

This casting cracked partly because the green core did not give enough. Similarly a sprue or a riser acting as a retaining post may cause damage and even the weight of mold sand on expansive surface of large area may produce an approximate effect. Blocking or hollowing a dry core out in some section of hard strain and filling in with green sand softly tucked and forming a part of the core surface is a further means used to prevent aluminum casting cracking. Another example of a cracked casting appears in long bars or strips ½-inch in diameter and 30 inches long. These bars were gated at the one end and when shaken out were found broken by linear strain into two sections over ⅛-inch apart.

The metal at the end opposite the gate froze first and pulled on the weaker metal section farther up toward the gate. At some point the metal simply let go and the two sections separated. In all such possibilities the molder simply has to use his head. Dry cores must be made collapsible or loosened in some way, green cores must be limited in their resistance. In the case of the 40-inch ring, the core was hollowed out up to within two inches of the pattern and filled with sifted ashes as shown in Fig. 6.

The 30-inch bars were gated at both ends; the sand was loosened around the sprues and the cope lifted off as soon as the metal started to set in the sprues. The thing to be done always is to present the minimum opposition to cooling movement of the metal, to fortify its points of weakness wherever possible and to feed it against cleavage in any manner advisable.

Two additional examples are presented. The first is shown in Fig. 7. This casting cracked at points *R*, *S*, *T*, etc. To remedy cracking, the hexagonal openings were cored green, cores being hollowed out and filled with sifted ashes. To strengthen points *R*, *S*, *T*, etc. gates were cut as at *A*, *B*, *C*, etc., and heavy fins located at *H*, *I*, *K*, etc. as shown by the projecting parts. Sand around sprues was loosened and cope lifted off as soon as metal set. This practice of tieing weak sections is common and efficient if properly done. The tieing sections as *A*, *B*, *C* and *H*, *I*, *K*, etc. should be of that form and volume as to set slightly in advance of the tied section. If remaining liquid until after, they have little holding power.

Fig. 8 shows a thin flat rectangular plate with a band cast at either end. The castings were multiple gated on the side resulting in the end bands cracking in cooling. Gates were transferred to *R* and *O* and castings poured double up. This *ran* the bands first of all leaving them to *set* while the top plate was running and prevented their cracking.

Overcome Shrinkage

Fig. 9 illustrates means of overcoming shrinkage in aluminum. *H* is a bottom gate to furnish cold metal to the heavy center body at point *M*. *A* and *B* are pouring gates for the thin plate. *N*, *O*, and *P* are metal chills to promote a more rapid freezing of the heavy metal body. Three pots are required to pour. Cold metal is poured down bottom gate *H* and delivered to the heavy center body until this body, by looking down the riser is seen to be nearly full. Then hotter metal is poured through *A* and *B* to run the thinner section and join the colder metal of the central hub. *R* is a riser to feed the freezing heart of the hub and from point *S* is filled with hotter metal direct from ladle *A* or *B*. The illustration is submitted to show in a single unit the more common methods of controlling shrinkage and their effect in combination. An analysis of the principles will confirm their soundness. By its lower temperature and its chilling in the mold, over 60 per cent of shrinkage is accounted for in the hub at the finish of pouring and the open zone moved up and directly under the riser so that shrinkage at the heart of the hub is dominated completely.

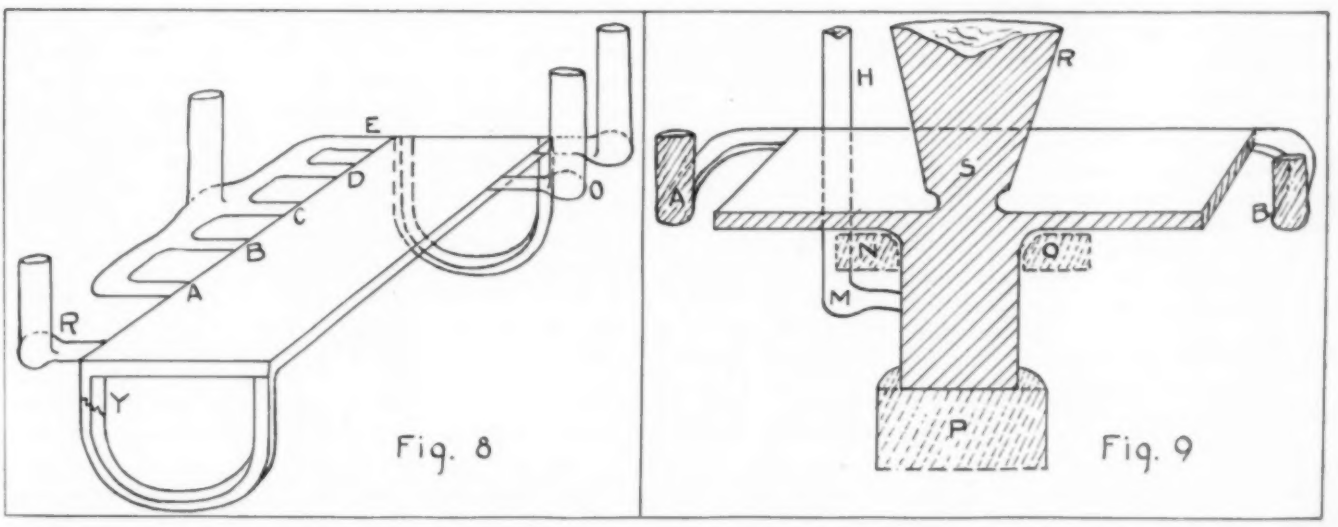


FIG. 8—GATES AT *R* AND *O* ALLOW METAL TO FILL THE BANDS FIRST AND THEN THE TOP PLATE. FIG. 9—ILLUSTRATING METHOD OF OVERCOMING SHRINKAGE IN A CASTING

How and Why in Brass Founding

By Charles Vickers

Wants Die-Cast Alloy

We would like some data concerning an aluminum alloy for die casting; the alloy will be cast in cast iron molds and the castings are cored. Should the cores be left cold to chill the metal, or will they require preheating? In regard to the alloy, we want one that will shrink but little in cooling, and it must have a fine grain and cast to a fine finish. We have in mind something containing copper to give toughness; aluminum for lightness and antimony for hardness. How should this be melted and mixed?

We will confess that we do not know how an alloy such as described should be melted and mixed. If our memory serves us correctly it seems we were never successful in attempts to alloy antimony and aluminum, as the metals invariably separated on cooling, so that merely a small amount of antimony entered the alloy and that was only harmful. We suggest that the idea of using antimony be discarded.

Also the addition of copper to pure aluminum does not confer toughness, it hardens the aluminum but an alloy of 92 per cent aluminum, and 8 per cent copper has no elongation worth mentioning, from 0.5 to 1.5 per cent only cast in sand; a little more cast in chills. This alloy known as No. 12 has been used extensively for making die castings, but in the case of pistons for internal combustion engines it is necessary to increase the copper to 12 or 14 per cent as it is then stronger at temperatures above normal, under which conditions such castings are operated.

An alloy of 90 per cent aluminum, 8 per cent copper and 2 per cent nickel also is considered good for die casting work, and another alloy is aluminum, 90 per cent; copper, 4 per cent; nickel, 1 per cent and silicon 5 per cent. An alloy that works well in cast iron dies is the following: Aluminum 86 per cent, copper, 12.00 per cent; iron, 1.5 per cent and silicon, 0.5 per cent.

Mixtures should be made by melting rich alloys, known as *hardeners* with the required amount of aluminum; thus a rich alloy of copper and aluminum contains 50 per cent of each metal. Therefore, to make an alloy containing 12 per cent copper it is necessary to melt 24 per cent of the rich copper-aluminum alloy with 76 per cent pure aluminum ingot. The alloys can be melted in either graphite crucibles or cast iron kettles. Both are objectionable but it seems the best we can do at present. The iron kettle adds iron to the alloy, and the graphite crucible has to be watched carefully to see the temperature of the metal does not rise to the point where the action of the graphite will promote reactions between the aluminum and oxygen, nitrogen and carbon, as such products cause trouble.

Brass Gives Trouble

We are sending you a sample yellow brass casting that has caused us considerable trouble as you will observe. This casting is a short flanged bushing with a heavy projection on the inside which is formed by the core. A matchplate is used fitted with 4 patterns and the mold is made using a cover core. As high as 20 per cent of the castings come with the mushy appearance shown by the sample. The material is a No. 1 yellow brass ingot, poured at 2100 degrees Fahr.

The appearance of the casting would indicate that it had been poured with metal too cool, but this cannot be the case with yellow brass poured at 2100 degrees, as this is high for yellow brass, especially in the case of a rather massive casting such as the sample.

If a long string of molds are poured from one ladle or crucible, it is possible those last poured will get too cool metal. Thus the defectives would be found largely in the last molds poured from a heat. This can be checked easily. It is also possible that in pouring the metal will *string* from the lip and this surface-oxidized metal is being permitted to fall into the sprue of the mold next poured as the pot is being put into position. This also is checked up easily.

Another possibility is that the brass is too high in zinc to make a good casting metal. With much over 30 per cent zinc content it will be a difficult matter to make the castings without great loss as the alloy is too sluggish to flow perfectly. The remedy is to either add copper and drop the zinc content to around 28 per cent, or to add one ounce aluminum per hundred pounds of brass. The copper addition is best with castings of the shape under consideration, because the aluminum is likely to cause trouble due to shrinkage of the internal boss, and also from drossing. Drossing can be controlled by pouring the metal from the bottom. In this case it can be done by putting the sprue through the drag, then *rolling over* the molds for pouring, but this is often a nuisance.

As a loss of 20 per cent will absorb the profits something has to be done to prevent it. We suggest an analysis of the metal as a first move, if checking up as suggested above develops nothing of value. It is likely the analysis will prove a surprise as to the composition of the alloy in which case the maker of the ingot metal may share in the pleasure. Anyhow, it then will be easy to figure the proportion of copper necessary to be added in order to bring the alloy inside of good sand casting limits.

Withstands Salt Water

We want to get a formula for an aluminum alloy that will withstand salt water, as we are making aluminum crank case castings for sea-going boats. We understand there is such an alloy.

There are probably quite a number of proprietary aluminum alloys for which claims are put forward in regard to their resistance to salt water and other corrosive agencies and a suitable alloy can no doubt be obtained from producers of aluminum alloys. However, should it be desirable to make up the alloy in the foundry from new metals, use aluminum ingot, 91 per cent; copper, 3 per cent, and silicon, 6 per cent. The alloy can be put together by the use of rich alloys of copper and aluminum, and copper and silicon. These alloys now can be purchased ready made and while the copper-aluminum alloy is quite easy to make, the silicon-aluminum alloy is quite difficult and therefore, it is advisable to purchase it ready made.

IRON AND STEEL ALLOYING MATERIALS

By J. M. Quinn

Modern steelmaking has been influenced strongly by the development of various alloys. The subject is gaining increasing importance owing to the large production of alloy castings. To add further to the fund of necessary knowledge and information the accompanying table which will appear on DATA SHEET NOS. 695 and 696 gives the comparative melting ranges of several metals and alloys which are used frequently.

It will be noted in certain cases, that the melting ranges extend over a wide interval of temperature, and good agreement is not always found among different observers. These divergencies undoubtedly are caused in part at least, by the varying amounts of impurities in the specimens tested, difference in calibration bases, and atmosphere and experimental arrangement.

While the melting points of these alloys give some information to the makers of iron and steel castings, they do not play the dominant part. The most important feature is really the *solubility point* or the temperatures at which the alloys go into solution in the iron and steel. However, no data is available on the solution points of ferroalloys although Dr. Fay, Massachusetts Institute of Technology, Cambridge, Mass., is inclined to agree that such solutions take place below the melting point of the ferroalloy. The bureau of standards expects to experiment along this line in the near future.

Further details and comments on the ferroalloys which will be listed in the table are given as follows:

Chromium

Carbon free chromium, 97 to 99 per cent[1], is used chiefly in the production of special alloys of high chromium content and its cost is high—used in the manufacture of high resistance wire such as nichrome—also for metals such as stellite. It is a silver colored brittle metal and its fracture shows no grain or fiber.

Carbon free chomium, 60 per cent, is used by manufacturers of chrome steel where low carbon content in the steel is important or close carbon limits are specified. Also in stainless steel which contains about

(*Continued on Data Sheet No.* 694)

IRON AND STEEL ALLOYING MATERIALS

(*Continued from Data Sheet No.* 693)

0.10 to 0.40 per cent carbon and 12 to 16 per cent chromium. Its appearance is similar to the 97 to 99 per cent metal.

Ferrochromium (high carbon), 67 per cent[2], containing approximately 6 per cent carbon does not have a definite melting point, but passes through a mushy stage as the metal cools from the temperature at which solidification begins.

Ferrochromium (low carbon), 67 per cent[2], containing about 2.70 per cent carbon has a fairly definite melting point at approximately 1500 degrees Cent.

Cobalt

Carbon free cobalt, 97 to 98 per cent[1], is used principally in the manufacture of stellite and high-speed tool steels. It is believed by some authorities that when 4 or 5 per cent cobalt is added to high-speed steel containing 15 to 18 per cent tungsten, the cutting quality is enhanced greatly. However, other authorities do not agree that cobalt gives high-speed steel better cutting properties. Cobalt is tough and fibrous and cannot be crushed.

Manganese

Carbon free manganese, 94 to 98 per cent[1], is used in the manufacture of the highest grade of manganese-copper, nickel castings, cupronickel, nickel silver and other special alloys. It has a light steel gray color and is brittle with a fine dense grain.

Ferromanganese, 80 per cent[4], analyzing approximately 78 to 82 per cent manganese; 6 to 7 per cent carbon; about 1 per cent silicon; under 0.25 per cent phosphorus and trace of sulphur, is used extensively in iron and steel manufacture for deoxidizing and alloying with the metal. This alloy is a steel gray color and brittle.

Manganese-titanium[1] analyzing approximately 55 per cent manganese; 30 to 35 per cent titanium; 5 per cent aluminum; 2.50 per cent silicon and 2.50 per cent iron, is a powerful deoxidizer and is used chiefly in nonferrous metals, although during the war this alloy was used in connection with the manufacture of special forging steel. The alloy has a dull gray color.

(*Continued on Data Sheet* No. 695)

THE FOUNDRY DATA SHEET, NOV. 15, 1927

Payment will be made for all contributions on foundry and pattern shop practice suitable for publication

Bill Sees Copper Tuyeres Made

By Pat Dwyer

SHORTLY after I settled down comfortably with a pipe and a paper before an open fire the other night a young lady pushed the paper to one side and boldly climbed on my lap. Serenely unconscious of the manner in which she was flirting with a sudden and violent death, she squirmed and shifted around from one position to another until she was perfectly comfortable and then had the sublime impudence to warn me not to breathe too deeply. Although my circumference at the equator is slightly more than it was at her age, still I reminded her she was in no danger of falling, particularly as she thoughtfully had taken the precaution of curling one of my arms around her diminutive waist.

This young lady's mother has warned her on many occasions of the dangers incident to her pernicious habit of lap climbing. She claims—of course a rank heresy—that the clouds of tobacco smoke will choke her, or at the least will set up an irritation in the respiratory organs. Also—another doubtful point—that she distinctly can smell the clinging odor of tobacco smoke when she is brushing the little lady's hair in preparation for school on the following morning. In answer to these various objections the gallant young party of the second part says: (a) that she likes the smell of tobacco smoke and (b) that she is perfectly willing to forego the elaborate hair preparation part of the morning toilet. Nothing could be fairer than that. My own objection is based on two rather serious points, but as I have neglected up to the present to announce them publicly, I am afraid I have ruined any chances I may have had in impressing their serious import on her frivolous young mind. I cannot hold a paper in one hand and read with any degree of satisfaction. I have tried on several occasions and nearly ruined a pair of perfectly matched eyes, hopping from side to side of a restless little curly head. I do not pose as an authority on the silent drama and its exponents, but sometimes I wonder if a like experience may not have been responsible for Ben Turpin's famous pair of goo-goo peepers. The usual explanation for google eyes in the foundry is that the owner got that way from keeping one eye on the boss and the other eye on the lunch box, but I have my own opinion, particularly if the owner is a family man. In fact taking one thing with another, by and large, as the saying goes, I think any man who raises a family in these strenuous times and escapes without a permanent kink in one or both eyes, is to be congratulated.

The second point on which I base my objection has to do in a modified manner with the well known problem of the irresistible force and the immovable object. The irresistible force is represented by a head set firmly on a pair of violent young shoulders and the immovable object is a corncob pipe clinched between two rows of one time pearly teeth. The result of the collision is a shower of ashes on the floor, followed by a horrified protest from a certain lady with an eagle eye—two eagle eyes. Sometimes the ashes and few odd sparks fall on the dainty neck of the irresistible object. In the first instance she is ordered peremtorily from her perch. In the second, she usually jumps to the floor voluntarily. In either case the seance is over—for that night.

You may say, and I admit with a certain degree of justification, that the remedy for this kind of imposition lies in my own hands. I might wait until she is comfortably settled and than by a skillful accident drop a hot coal down the back of her neck. That idea has occurred to me. Also I have toyed with the advisability of applying the business end of a blazing match to the tip of one of her little pink ears.

Up to the present I have been restrained in this laudable ambition through two trivial reasons. First I have lacked the necessary courage of your true he-man who lets nothing stand in his way. Second I have reflected—reflection in some quarters is regarded as an indication of approaching senility—that for many years before this young lady appeared on the scene I had opportunity to read the paper without interruption. Also in the natural course of events, after she has passed the brief lap climbing stage, I will have many years to read it again without interruption, with the possible exception of interruptions incident to intimate and poignant memories that reach down and tap the heart roots of domestic life. With this brief digression, hailed as gospel by those who have little maidens of their own and condemned whole heartedly as absolute drivel by those who have none, let us return to the cheerful scene in front of the open fire where our hero is shown in his great nightly juggling act, balanc-

TEACHER PUTS A FAST ONE OVER THE PLATE

ing a paper in one hand, a pipe in his teeth and a young lady on his knees at the imminent risk of a general and spontaneous holacaust.

"Listen Paw," said the young interrogation point, who can ask more questions in a given space of time than six strong men can answer in the same space magnified 100 diameters, "What is a Moravian?

"But, my dear," I wheezed in popular novel style, "I do not quite understand. If you will kindly—"

"Oh, now, don't act so dumb," she chirped brightly. "Our teacher was talking about history today and she told us when we went home to find out all about the Moravians." "Why didn't she tell you herself while she was on the job?" I naturally inquired. "Seems to me if I was a teacher, which heaven forbid, paid for attempting to hammer knowledge into succeeding generations of young and dumb humanity, endowed in inverse ratio with stomachs and brains, I would attend to the work myself instead of trying to shift the burden on to the shoulders of hard working parents. Why should I be penalized for—"

"Why don't you tell the child what she wants to know?" the lady of the house inquired at this point; insinuating herself into a private conversation, mind you, without any invitation.

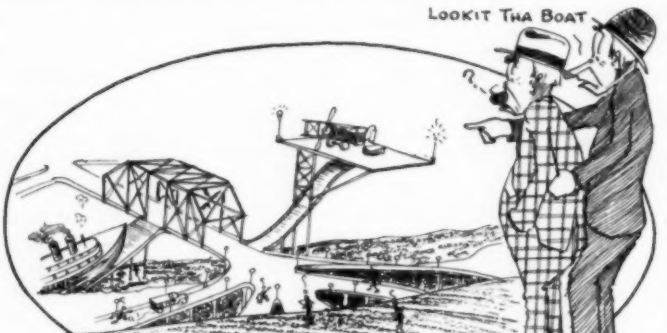
I did not think she even had been listening to our little tete-a-tete. She has the most remarkable faculty of hearing things while apparently engaged in some occupation of her own that would claim the entire attention of any other person.

"If you know anything about the subject," she continued, "tell her. If you don't know anything about it, which probably is the cause for your obvious stalling, tell her so, frankly, instead of sowing seeds of distrust in her mind regarding our educational system."

Before I could rally the horse, foot and artillery to meet this unwarranted and unexpected attack, Bill came in and joined the harmonious little family circle. His arrival was as opportune as that of Blucher at Waterloo, the Irish Brigade at Fontenoy, Havelock at Lucknow, Sheridan at Winchester, Roosevelt at San Juan hill, Nick Carter at the haunted house, or the wood cutter at the home of Red Riding Hood's grandmother. In a word and not to put too fine a point on the situation, the flag was saved.

I told Bill I had just given the young lady on my lap a brief description of the Moravians. The young lady's mother contributed the remark that I displayed a happy facility in choosing my adjectives. "Brief," said she, "is good!"

Well," said Bill, "I'll tell you. This is rather a funny coincidence. I was in Bethlehem, Pa., a few weeks ago, the head quarters of the Moravians in this country, where as the guest of my old friend Bill Shennan I learned many interesting facts in the history of these high minded and heroic people; early missionaries to the wilds of North America two hundred years ago. Bill is a master foundryman, connected with the Bethlehem Steel Corp., for over 40 years and general superintendent of foundries in the Bethlehem plant for many years before his retirement a few years ago. Some of the largest and heaviest castings in iron and steel ever attempted in this country have been made under his superivision. His knowledge of Bethlehem, its history and traditions, is as interesting and comprehensive as his foundry lore.



SUPPOSE HORATIUS HAD TO DEFEND THIS BRIDGE

"Bethlehem with a present population of 65,000 has grown considerably since I first saw it about 20 years ago, when the population was reckoned at 38,000. It is not quite so populous as it was in the recent war years when 33,000 employes toiled by day and night in the great shops of the Bethlehem Steel Corp., that extend for over 3 miles through the center of the city and are ¾-mile wide in some places.

"The city is built on the sides of two hills that rise steeply from the Lehigh river which turns at this point and thus was responsible for the construction of the most remarkable bridge in this country if not in the world. The local inhabitants seem to experience no trouble in finding their way through its various mazes, but certainly I should hate to be turned loose in the center some dark night without a guide, a compass, a chart and a set of sailing directions printed in simple terms and in large type. I may be mistaken, but my private opinion is that the author of that beautiful and touching, sentimental ballad entitled *Show Me the Way To Go Home*, wrote it on that bridge.

"If the late Mr. Longfellow had wandered on that bridge at midnight when the clocks were striking the hour, instead of standing upon his own familiar Charlestown bridge, the experience would have provided inspiration for a poem of at least six cantos—perhaps eight. The bridge has eight main approaches, four at grade level from the hills and four in the form of ramps leading up from points in the valley. I think the lad who designed it must have had his early training in a dentist's office. It is a beautiful job, recently completed and worthy of taking a place alongside any of the many natural and artificial attractions of the famous Lehigh valley." "You will pardon my natural curiosity," I mildly interrupted, "but what has all this to do with the Moravians?"

"Keep your hair on," Bill rejoined easily. "I am coming to that point."

"That's fine," I said. "I thought perhaps you were lost and were going to remain on the bridge all night, uttering loud cries for help."

"Bethlehem," Bill continued, "is permeated with references to the Moravians past and present. Various places and objects bear the name of Nicholas Lewis, Count Zizendorf, powerful protector and patron of the persecuted brethern, who furnished transportation for the first colonists and gave them a grant of land on his extensive property at the forks of the Delaware.

"Hardy pioneers, actuated by the highest ideals and every day exponents of the cardinal virtues, they flourished like the proverbial green bay tree and built up a wealthy and influential community. Their young ladies seminary is one of the oldest in this country. For many, many years they have maintained a theological seminary where young men with a religious vocation are kept and educated free of all charge.

"Music enters extensively into all their activities. An exceedingly interesting and colorful musical pageant staged every Easter Sunday attracts visitors from a wide radius.

"A cemetery adjoining the meeting house on the hill is laid out in long straight rows of little mounds, each

mound surmounted by a small, plain, flat stone slab, 15 x 15 inches, 2 inches thick, bearing simply the name and two dates, birth and death of the person reposing below. The rows are arranged in chronogical order commencing at the northwest corner. The arrangement in its beautiful simplicity, orderliness and lack of ostentation typifies in a striking manner the ideals, spirit and democracy of the people. The first three graves bearing dates between 1730 and 1740 are those of early Indian converts.

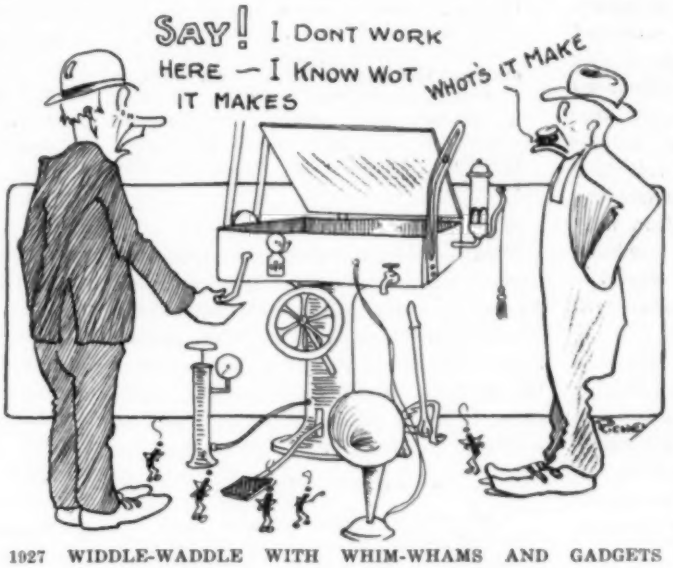
"Early Easter morning a band of trumpet and trombone players clothed in flowing white vestments, issues from the church and marches in solemn procession to the eastern limit of the cemetery where the rising sun is greeted with pealing floods of melody. Clear and resonant, the ringing golden tones mingle in sublime and exquisite harmony, a triumphant salutation of the living to the risen Saviour. Soft and low on the return journey trumpet and trombone breathe a gentle requiem over those who now lie in their quiet graves, man and boy, matron and maid, infant and hoary patriarch. Those who died yesterday and those who died in the long ago.

"I might touch on several other interesting features in this town replete with scenic beauty and historical associations, but I see the little lady is asleep. She won't mind if I switch to another subject. I was in a foundry the other day where the lad in charge has developed the best rig I ever have seen for making copper tuyeres for the blast furnace. I have made these tricky castings and have seen them made in several places with methods and equipment that were fairly satisfactory.

"Some foundrymen insist on dry sand molds, while others stick to green sand. In some shops the casting is poured big end up, with the chamber core suspended from the cope or supported on chaplets on the bottom. In other places the entire pattern is molded in the cope, big end down with the core resting on the water inlet cores and anchored with wires through the bottom board. The rig I saw the other day has all the others trimmed a mile.

"The casting is molded and poured big end down with the entire body in a one-piece, cast-iron flask that serves for both cope and cheek. The drag is one of the unique features of the equipment. It is a cast-iron plate ribbed on the bottom for strength, drilled on the face for core prints and equipped with a pair of stationary pins for guiding the cope into place. The face is machined to a true plane and carries a single small gate channel from a point near one corner to a point near the print for the center core.

"This print ¾-inch deep is machined accurately with tapered sides to receive a small round plate on which the center core is rammed in an independent corebox. The corebox is provided with a similar print which insures that when the core is lifted from the box with a suitable center bolt and placed on the drag plate of the mold, it will be located accurately to give a uniform thickness of metal between the center core and the chamber core. This green core is made from a strong mixture of new and old sand, is provided with a 2-inch vertical vent hole in the center and is not dried. The lifting bolt is unscrewed and removed after the core is in place.



1927 WIDDLE-WADDLE WITH WHIM-WHAMS AND GADGETS

"Openings for the reception of the chamber core prints are drilled to a depth of 1 inch in the drag plate. A ⅝-inch hole in the center of each one is drilled the remainder of the distance through the plate. The corebox is placed on a small flat iron ring with pockets corresponding to the openings in the plate. A ⅝-inch tube, threaded at the lower end and pierced with numerous vent holes is placed upright in each pocket and then the corebox is filled with sand and jolted. The sand is a half and half mixture of coarse bank and silica sand and is bonded with rosin. When the corebox is removed the iron ring remains on the bottom of the core and supports it while it is drying in the oven.

"The dried core is removed from the ring and lowered into place around the center core on the drag plate. The prints guide it accurately into place and the threaded ends of the tubes project below the plate where they are secured with nuts. Everything straight, true and tight, an absolute insurance against thin spots either on the inside or outside walls of the casting.

"A stripping-plate, jolt machine is employed to ram the cope in a plain, square, cast-iron flask with a single upright runner in one corner. The cope is lifted from the machine by a small crane and lowered over the chamber core into place on the drag plate where it is held with two clamps. The entire outfit is the essence of simplicity and accuracy. A row of drag plates is mounted on a permanent trestle elevated 18 inches above the floor for the convenience of the operator in attaching and disengaging the nuts which hold the chamber cores in place. The plates also remain permanently in place. After the casting is poured, casting, mold and cores are removed as a unit. The plate is blown clean with an air hose and made ready for the next assemblage of the tuyere mold.

"Metal for the tuyeres made up from a mixture of virgin metal and scrap tuyeres from the blast furnaces, is melted and poured from a crucible with a capacity sufficient for four castings. The temperature of the metal has to be held within close limits. Experience has shown that where more than four tuyers are poured from the same pot, the variation in temperature will cause the castings poured at the first and last of the heat to leak under pressure."

"Seems to me," I said, "you must have been hanging around all day to gather up all that dope."

"Fat chance," said Bill. "I just walked through the place. In one door and out through the other. Give me one good look at a new rig for making any job with which I am familiar and I can duplicate it from memory."

Receives Award

The council of the Iron and Steel Institute of Great Britain recently awarded the Carnegie gold medal for 1925 to A. L. Curtis, Westmoor Laboratory, Chatteris, England, in recognition of research on steel molding sand.

Welding Steel Castings

Three Processes Are Used To Repair Defective Castings—Selection of Method Depends on Nature of Defect and Type of Casting

By L. E. Everett

WHILE the writer describes herein the conditions leading to the selection of a welding process in the steel foundry, it is to be remembered that the selection and the process both are confined to steel foundry practice. The Nugent Steel Castings Co., Chicago is equipped to do welding by any one of three processes. In this article the author will endeavor to tell how the process is selected for the welding to be done. That the exposition may be followed more closely, the products of the foundry, the reason for the welding, and the type of welds will be described first.

The Nugent company operates an electric steel foundry with a monthly capacity of approximately 600 tons of small and medium size miscellaneous steel castings. Castings of some designs up to several tons can be made, but the average weight per casting is around 25 pounds.

Production is confined largely to straight carbon steel castings, but in addition thereto alloy steel castings are made for the more severe service requirements of customers.

Shows Importance of Welding

Before proceeding with the discussion of the selection of a welding process, the relative importance of welding in manufacturing operations and the precautions taken when welding is required, will be shown. Welding of any nature is seemingly an unavoidable evil in the steel foundry and is used merely as a means to an end. It is used to overcome defects that were not eliminated otherwise, and, while the foundry practice at this plant has been improved through some years of intensive and comprehensive research, the necessity for welding has not been eliminated entirely.

Art of steel founding still is a long way from perfection and the causes of defects are many and varied. Some of the defects that necessitate welding, and their causes, that the character of the blemishes and their extent may be appreciated:

Dirt spots, caused by small extraneous bodies of sand or other foreign matter lying in the cavity which later is filled with metal.

Sand spots, caused by the molten metal cutting or washing some comparatively loose sand into the mold cavity and entrapping it there.

Slag spots, caused by slag entering with the molten metal or by the fluxing of the mold surface.

Scabs, caused by the molten metal cutting the mold surface and mixing the sand and metal together in such a manner that areas or layers of sand and steel are mixed or superimposed, forming a lump on the casting.

This article is abstracted from a paper read at the International Acetylene association's convention held in Chicago, Nov. 10-12. The author L. E. Everett is research engineer for the Nugent Steel Castings Co., Chicago, and has made a special study of welding methods and processes.

Shrink cavities, caused by the shrinkage of the steel during solidification when insufficient provision is made for feeding molten metal to the solidifying region.

Blow holes, caused by wet sand, wet cores, hard rammed sand or anything in the mold that would cause sudden generation of steam or gas, or would prevent the rapid exit of the natural steam or gas when the mold is poured.

Cracks, caused either by the resistance of the mold to the contraction of the cooling steel while it is in a semiplastic or weak condition or as the result of the stresses set up during this cooling process.

Other defects of a more easily avoidable nature caused by unfamiliarity of the workman with the various castings are as follows:

In removing heads or risers with the cutting torch, they are sometimes burned or cut too low.

In flogging, the heads and gates sometimes break back into the casting.

In finishing, surfaces sometimes are ground too low.

All of the above and many other defects are preventable, but in a foundry handling many pieces, from many patterns, new defects or new arrangements of old ones show up daily. While these defects are largely of such nature that they interfere with the appearance rather than with the serviceability of the castings, any evidence of such defect is not tolerated on the finished product. To put it bluntly, some welding process is used to repair all small defects in castings. It is not a major operation, not a vital accessory to the finishing department, but it is done because a casting of better appearance and in some cases more serviceable nature is assured through the judicious use of one or the other welding processes.

Determining Factors

This brings us to the point of defining the rather vague zone of whether a defective casting should be welded to save it or whether it should be scrapped. In general, if the defective area is small and in a location where it has little effect on the strength of the casting, it would be welded. If the defect is large, and if the cost of welding would exceed or even aproach the cost of remaking the casting, or the strength and service value of the casting would depend largely on the weld, to remaking the casting is preferred.

Users of steel castings realize that many of the castings have defects which do not interfere with the usefulness but which do impair the appearance of the casting. Many foundries cover up these defects in a superficial manner and others weld the spots without cleaning them thoroughly. In other words, the holes merely are disguised, or the spots covered up and called a job. These practices now are frowned on by the leaders of the industry, with the result that as a class the welding practice of steel foundries is improving.

The Electric Steel Founders' Research group, provides a rigid, strict and severe set of inspection standards which govern its welding practice as follows:

First, for repairing small defects of any kind, the use of any metallic cement or smoothing filler strictly is prohibited.

Second, the repairing by welding of any cracks or other defects, however small, is permitted only when authorized by the inspectors or their superiors who personally are responsible for the strict application of the inspection standards. Cracks, blow holes or shringage cavities are thoroughly opened up before welding. All sand, slag or other foreign matter is removed by cutting down to clean, sound metal before operations commence.

Third, as a precaution against slovenly workmanship, no welding operator may be compensated on a piecework basis, or wage plan basis involving any premium for quantity production.

It is realized that when castings are welded, stresses are set up which are similar in character but less in extent than those caused when the casting solidifies in the mold. Composition of the weld metal differs from that in the casting proper, because the heat applied in welding is sufficient to allow some of the elements in the welding rod to oxidize or otherwise change their nature. Quicker cooling of the weld metal gives it a different structure than the metal cooled in the sand mold, and frequently this more rapid cooling also gives the weld metal a greater hardness than has the casting metal. For these reasons the inspection standards also provide that all castings shall be heat treated after welding, to render the weld metal more nearly like that of the casting composition and structure. Welds made in this plant are largely of such small size and by a heat treatment sufficiently thorough, homogeneity is attained practically on all welded castings.

Preliminary and Finishing Routines

To explain the selection of a welding process and the care evidenced in making this selection, it is necessary first to show the preliminary cleaning and finishing routine. Castings enter the cleaning room in two ways. The smaller castings coming from the shakeout floor, have their heads or risers and gates either flogged or cut off in a sprue cutter, and then are taken to the tumbing barrel or sandblast where all adhering sand is removed. Larger castings go direct to the sandblast or to a special chipping floor, where the sand is removed from the neck of the risers, these large heads then are removed by means of the oxyacetylene cutting torch. Castings of both classes are collected on an inspection floor where they are gone over carefully for defects. Castings with minor defects which can be repaired by welding are marked, the defective areas being outlined with chalk, and sent by the inspector to one of the welding units.

A chipping floor is arranged in conjunction with each welding unit and all defects to be repaired first are chipped out to clean, solid metal. In the majority of cases, where the weld is at all important, the chipping is passed on by the inspector before the casting is permitted to go to the welder. In this manner a base of sound metal is insured for the weld. Welding equipment for the following processes is maintained: Bare metallic electrode process, carbon electrode process and oxyacetylene process.

In selecting the repair process, the size of casting, the size, character and location of the defect, the type and application of the casting, all have a bearing. The cost and productive capabilities of the processes also must be considered. Let it be understood that no claims for the superiority of one process over another are made. Experience at this plant has been guided by research, and the application of the particular process to practice is based on these factors.

Consider first the bare metalic electrode welding process, which is used in this plant to make small repairs such as are made necessary by slag and sand spots, small blow holes, etc. This process also is used on surfaces which are to be subjected to machining operations. Generally speaking, the application of the metallic electrode is confined to smaller castings, and the smaller defects on the larger castings. Welds made by this process are found to be well fused with the casting metal and to be sufficiently strong, ductile and soft, after thorough heat treatment of the casting, to be machinable and apparently satisfactory.

In regard to the carbon electrode process, or carbon arc welding, as it is called, its greatest application at the Nugent Steel company is found in welding of larger defects in the larger castings. This method is a quick and cheap way of adding any appreciable amount of metal, and the welds seemingly are sound and sufficiently strong. In using this process recourse is had to the scratch brush and the hammer, and satisfactory welds of fairly large size are made comparatively quickly and cheaply. It gives a weld which, with proper dressing and after thorough heat treatment, is thoroughly satisfactory for this type of casting.

Leaks Are Welded

The oxyacetylene welding process is used largely in welding for leaks in our pressure fittings. Occasional application of oxyacetylene welding in actual manufacturing is found. In one instance facilities were inadequate for the manufacture of a certain casting, but through oxyacetylene welding, which for that particular time became one of the major operations, were enabled satisfactory and economically to complete the job. The casting was a ring or reinforcing band 90 inches in diameter, weighing about 300 pounds, and the U-shaped cross section provided for metal about one-half inch thick. No flask in the shop was capable of taking this pattern, nor could the entire ring be placed in the annealing oven, and it became necessary either to make a special flask and deliver the casting unannealed or else to cast the ring in two halves and weld them together. The latter procedure was decided upon and made several castings on the original order, joining the two halves with oxyacetylene welding. The job resulted in repeat orders.

Weld Heavy Pipe

Another case was that of a 24-inch pipe cross of 600-pound test, weighing 5400 pounds, which was part of an order for cast steel fittings for a high temperature, high pressure steam installation for an eastern power company. This casting was specified to be finished without welding of any character, but due to a change in design it became necessary to provide certain additional side outlets on the cross after the casting had been finished. The casting had been tested, and accepted by the customer, when this revision was made. To prevent the loss of the casting, which naturally was an expensive piece of work, the additional outlets were oxyacetylene-welded in place, the casting re-tested and accepted, and has been giving entirely satisfactory service since installation.

From the foregoing it might seem that welding is a major process. Such is not the case. Ordinarily welding is one of the minor functions of the finishing department of the Nugent Steel Castings Co., and such welding is largely incidental to the appearance of the casting. There are times, as in the two foregoing examples, when a great amount of dependence is placed on welding. While a considerable amount of such work is done, we are not proud of the fact. Every weld represents a defect repaired, and while the castings as received by customers are perfectly satisfactory, the welding or repairing of these defects is an added, although unavoidable, cost burden to the plant. Realizing that it will be some time before the manufacture of steel castings can be controlled to elminate defects in the product, this company has concentrated more or less on the obvious means to an end. Welding or repairing practice is being regulated by exercising the greatest precautions, by using the optimum method for the case in hand, and by thorough heat treatment after welding, a high quality in product is maintained.

INCREASES EFFICIENCY

In the Pattern Shop By Arranging the Machines and Benches Carefully To Avoid Backtracking of Materials Passing Through Production

By Walter C. Ewalt

MANY factors must be considered carefully when arranging machinery in the pattern shop if maximum efficiency is to be obtained. A careful study should be made of the various operations to be performed by the workmen. The machines to be used most should be placed near the benches of the workmen. The matter of light should be given attention and the benches and machines should be placed in such a way to receive the best light.

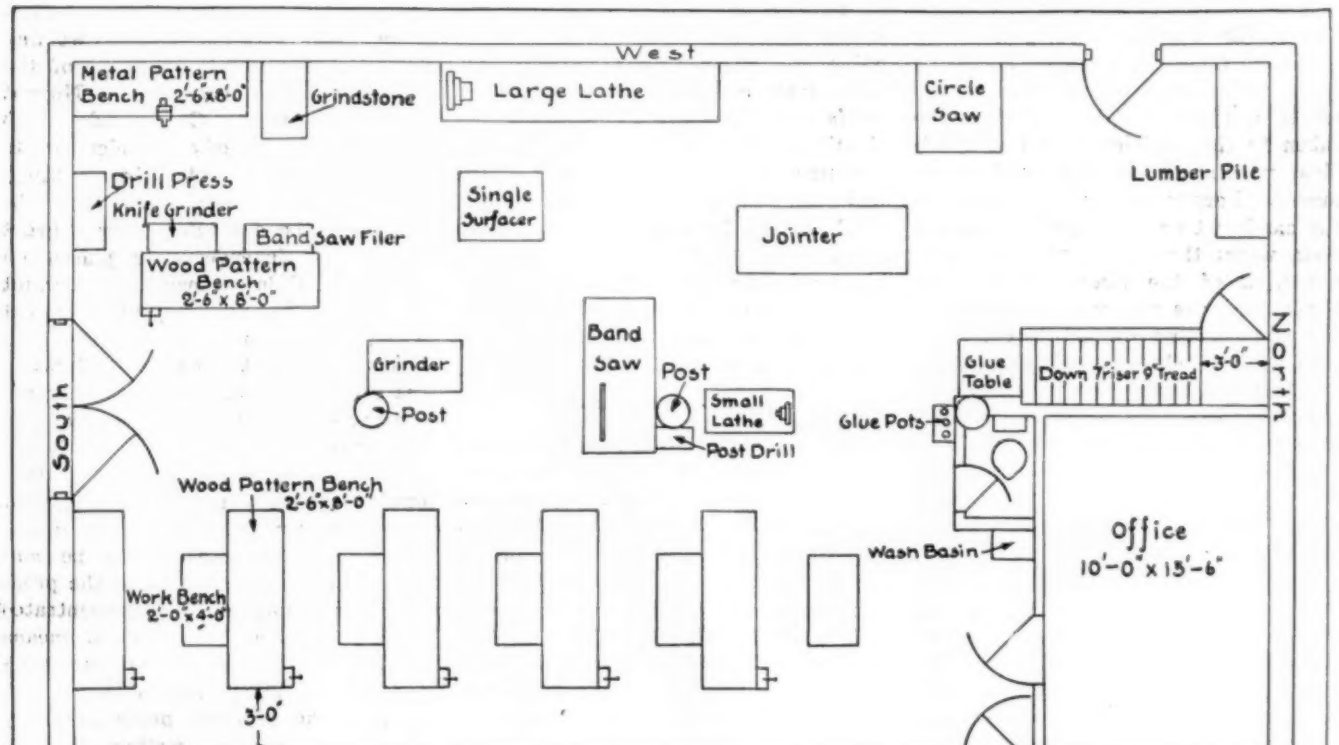
When a new building is being constructed and new equipment purchased, the design of the building and the equipment may be selected to fit the exact production requirements. If a new building is being erected to house machines formerly used in an old shop, the problem also is comparatively easy. However, when it is necessary to remodel an old building to meet certain requirements in the way of production, the problem becomes more difficult to settle satisfactorily.

Recently a company specializing in wood and metal patterns decided to remodel a one story building on its property to house the pattern shop. The building is 33 x 56 feet with a 10-foot ceiling, and the front of the building faces the east. Before the work of remodeling started the building had no openings or partitions for the office, no toilets and no stairway. The roof is supported by three columns in the center of the building.

Since the line of traffic is from the north, it was thought best to build the office in the northeast corner, as shown in the illustration. This location also avoids interference with the light reaching the pattern shop. A small boiler room was built under the office and the stairway constructed along the rear of the office. Supplies are stored in another building and brought through the door shown at the northwest corner of the illustration.

Equipment owned by the company consists of the following: One 24-inch wood turning lathe; one 36-inch band saw; one universal saw; one 24-inch planer; one 16-inch jointer; one 30-inch double disk sander; one small wood lathe; one post drill; one drill press; one grindstone; one perpendicular band saw filer; one knife grinder; six benches for working with wood; one bench for working with metal. Of course the machinery to be used and the construction of the office in one corner placed certain limitations on the arrangement of the work benches and the machinery.

At first it was thought advisable to place the six benches end to end along the east wall. However, it later was considered better practice to place five of the benches along the east side of the room, as shown in the illustration, with one bench near the southwest corner. The advantages of this arrangement are appar-



TO SECURE MAXIMUM EFFICIENCY, CONSIDERABLE CARE IS NECESSARY IN ARRANGING EQUIPMENT

ent. A large percentage of the time spent at the bench is devoted to work held in the vise. With the benches placed in the position shown in the illustration, the workman may move around the end of the bench. This permits him to do much of his work without changing the position of the material in the vise. It also gives a better distribution of light from windows along the east side of the building. Each workman has his own bench and therefore does not interfere with the other workmen. The bench for making metal patterns is located in the southwest corner of the room and the knife grinder, drill press, grind stone and saw filer are located in the immediate vicinity, as noted in the illustration.

Since the band saw and the grinder are used more frequently than the remainder of the machines, they are placed in the center of the room. The position of the circle saw is governed by the proximity of the source of supply. A supply of lumber may be taken from the storage of supply house next door and piled at the end of the room as shown. Running the work through the saw causes only slight interference with bringing materials from the storage house. The saw table is placed 12 feet away from the north wall. When it is necessary to saw a 16-foot piece, the lumber may be dropped over the saw and then reversed to cut the other end.

After the lumber has been sawed, it is taken to the jointer, which is only a few steps away. The next operation is performed on the single surfacer. The distance between the jointer and the single surfacer is 8 feet. The work is taken from the surfacer to the band saw, located in the center of the room, and is sawed into lengths for glueing. It then is taken to the glue table, where it is glued, clamped and set away to dry.

The small lathe and the post drill are located approximately in the center of the room since these machines are used extensively. The large lathe is located on the west side of the room chiefly because that is the only available place. The space at the south end of the building near the doors, which is about 8 feet square, is used when building up large patterns. When patterns are made which cannot be accommodated in that space, it will be necessary to secure a temporary space by moving one or more of the benches.

Chicago Pneumatic Tool Co., New York, has removed its Cleveland district office from 1241 East Forty-ninth street to 1727 Union Trust building.

Distribution Is Greatest Gray Iron Problem

(*Concluded from Page* 881)

their product. Direct and indirect advertising and publicity of various types should be employed. Gray iron producers should see to it that their industry is amply represented through papers, illustrated lectures, etc., before engineering societies and groups of users and the public in a general way should be made acquainted with the virtues of gray iron.

The merchandising methods of the entire industry should be improved. There are a number of ways in which this may be brought about. The relations between buyer and seller should be defined more carefully. There is much looseness in this respect at present and a great many misunderstandings are prevalent. The results secured through the use of the Uniform Trade Customs of the Ohio States Foundrymen's association have demonstrated conclusively that there is a need for some definition of principles between the buyer and seller of castings.

It has been a recognized fact for years that the foundry industry, particularly the gray-iron branch of the industry, has not been paying sufficient attention to costs. Due to the nature of the foundry business, it is more difficult to secure accurate, reliable costs than is the case in other branches of manufacturing. Logically, because of this condition, foundrymen should pay closer attention to costs than the average manufacturer. It is regrettable that the contrary has been true. If gray-iron producers did nothing more than give complete attention to the subject of foundry costs, this activity in itself would justify the existence of a national organization. The fact that more than a hundred associations in this country are today using uniform cost methods indicates, beyond any doubt, that it is a worth while activity.

The compilation and preparation of statistics relating to the industry is another desirable activity. A definite knowledge of plant capacity, of stocks of raw materials on hand, stocks received, production in the industry and items of this kind is desirable. These data furnish a track on which to run and indicate the direction to be traveled, eliminating much of the guess work and the unknown.

Undoubtedly, it would be found desirable, as the organization developed, to form various groups within the main body. Manufacturers interested in the production of certain types of castings having common problems of production and distribution could form their groups for discussion and the handling of these problems. The good accruing to the industry as a whole, those engaged therein and having contact with it through meetings of this kind would be immeasurable.

It should be mentioned that the activities proposed have stood the gruelling test of actual service. Many of the services mentioned have been rendered by the Ohio State Foundrymen's association for more than five years. The result has been a better feeling among those in the same line of endeavor, more confidence in one another and a greatly improved condition in business and public relations. Foundrymen, who for some reason or other, had grown suspicious of their competitors in the industry, meeting through the association found that their suspicious were not well founded. They have come to regard their competitors as entitled to respect and while desirous of obtaining the same results as themselves, real men of worth. The final result is that the buyers of castings, as well as those engaged in the industry, have profited.

Uses of Silica and Sand Described in Bulletin

Silica is an important material in industry and art due to its cheapness, hardness, resistance to ordinary chemical action and it refractoriness or resistance to heat. In 1924, over 160,000,000 short tons of silica products valued at $112,089,939 were sold or used in the United States. Due to its importance the bureau of mines has published a 204-page bulletin describing the technology and uses of silica and sand. Bulletin No. 266 describes the various forms of silica, their uses, occurence, recovery and market. Copies may be obtained from the superintendent of documents, government printing office, Washington, for 40 cents.

New Englanders Meet

The regular monthly meeting of the New England Foundrymen's association was held at the Exchange club, Boston, on Nov. 9. After the dinner at 6 o'clock, R. T. Turner, secretary, Shepard Electric Crane & Hoist Co., Montour Falls, N. Y., showed a number of views of installations of mechanical cupola chargers. Charles A. Roberts, general superintendent, Gurney Heater Co., Framingham, Mass., described the installation used by his firm.

WHAT OTHERS ARE THINKING

Abstracts Selected from the World's Foundry Literature

Gives More Malleable Data

Malleable Cast Iron, by M. Guedras, *La Revue de Fonderie Moderne*, June, 25, 1927.

This is the third article written by M. Guedras on the subject of malleable cast iron. This chapter is devoted to the manufacture of the primary metal. The author first refers to melting in the cupola and recommends using only one row of tuyeres. He mentions that on one occasion when the blower had gone out of order, a 5-ton cupola was maintained in operation for four hours simply by opening the tuyeres and introducing small pieces of coke or, better still, anthracite. The author emphasizes the necessity each time the blower stops of opening the peep holes of the tuyeres and only to shut them again when blowing is resumed, to prevent explosions. For the calculation of the burden the author states that it is the foundry chemist who should be responsible for this work. Two elements are to be determined precisely, silicon and manganese. It is recalled that the average loss in the cupola is 8 per cent silicon and 12 per cent manganese. The author then gives examples of burdens made up of various compositions. About 1.6 ounces of 80 per cent ferromanganese should be added to each charge. The author refutes the contention that no annealed discarded pieces should be added to the burden. There is no inconvenience in adding such scrap providing the analysis is known.

The author lays stress on the necessity of adding a sufficient quantity of flux, and gives the manner in which the calculation of the addition should be made. It is always advisable to obtain basic slag as in this way the loss of iron is minimized. It is pointed out that these slags are not so fluid as acid slags.

In melting in the reverberatory furnace, the article deals with the American type, which is described at length.

Investigates Cupola Practice

Theory and Practice of the Cupola During the Last Decade, by Prof. Walter Mathesius, *Stahl und Eisen*, Dusseldorf, July 28, 1927.

After discussing the work done by Buzek, Belden, Cook, Piwowarksy and others, the author concludes that the best operating conditions are as follow: Fuel ratio excluding bed, 8 per cent to 10 per cent maximum. Air volume of 300 to 360 cubic feet per minute per square foot of cross sectional area. Air volume and not blast pressure is the deciding factor for good working conditions. Air should be distributed uniformly. Best cupola operation is obtained with the largest number of tuyeres. Melting capacity of a cupola in good working condition is given by the author as 31 to 37 pounds per square foot cross section per minute.

With smaller air volumes, the melting rate is increased with increase of air. After a certain point is reached, however, no increase of melting rate takes place. The highest temperature of iron coming from the cupola has been found to be 2600 degrees Fahr., and experiments were made to obtain hotter iron by enriching the air with oxygen and by preheating the air. Results obtained were not practicable from a commercial point of view. Difficulty in obtaining hot white iron from the cupola is explained as follows: White iron contains carbon as cementite and melts at a temperature of 2200 degrees Fahr. After it melts it drops down to a relatively cold bed where it remains at a temperature not much above its melting point.

Gray iron on the other hand contains most of the carbon as graphite which is refractory. The iron liquifies at 2200 degrees Fahr., but is held within the graphite flakes which prevent it melting down until a temperature of 2500 degrees is reached. At that temperature the graphite lattice is so weakened that it breaks down and allows the iron to pass down through the bed. Hence, gray iron may be superheated considerably while white iron cannot be as it runs down as fast as melted. The author also mentions that old experienced foundrymen prefer pig iron with large graphite flakes. He explains this preference is due to the graphite flakes not breaking down until high temperatures are reached. The high temperture produces a more fluid, better degasified and cleaner iron which makes better castings.

Gives Air Furnace Practice

Air-Furnace Practice, by Christian Kluijtmans. *Foundry Trade Journal*, London, Sept. 8, 1927.

In this second article by the author on the manufacture of black-heart malleable iron in Europe, he describes the oxidation of the constituents of the charge; the influence of the constituents on iron as cast; influence of constituents on annealing; melting practice; taking of test plugs and tapping the metal. Numerous tables are included in the article giving data obtained in operation. In a furnace working normally the oxidation of the silicon increases with decreasing carbon content. The author includes carbon-silicon ratios which he found useful in practice, and goes into considerable detail on melting practice. To explain the text matter, the author has included a number of illustrations of fractured test bars taken under different conditions and with each has included comments as to the procedure to be followed when the temperature is cold, medium, fair, hot or extremely hot. In conclusion the author outlines methods of maintaining the tap-hole, care of the bungs, grate bars, front bridge and chimney.

Fluxing the Cupola

The Use of Fluor Spar in the Cupola, by L. Piedboeuf, *La Revue de Fonderie Moderne*, Paris, July 10, 1927.

The use of fluorspar in the cupola is beginning to spread in France and Belgium, and the author discusses certain articles published in the German technical press. The results of researches made by Wilke-Dorfurt and Buchholz are given in *Stahl und Eisen*. Experiments were made in a crucible containing about 500 grams of cast iron and 125 grams of cupola slag containing 0.23 per cent sulphur. Three times in succession the iron was treated with fluorspar and remelted, and it was found that the desulphurizing effect was considerable. However, experiments made in the cupola showed that the result was negative. The author then comments on the work of Klingenstein, related in *Giesserei-Zeitung*, June 1, 1925, the conclusion of which is that it is to the advantage of founders to employ flux of superior quality and in sufficient quantity to comply with the composition of the coke and of the melting zone. It is further stated that where the addition of fluorspar has improved condition in the cupola, it was in cases when the operation of the cupola was not normal, and that either flux of bad quality was used, or else it was not used in the proper proportion.

Breaks Heavy Scrap

Breaking Heavy Metal Scrap, by M. J. Duvuvier, *La Revue de Fonderie Moderne*, Paris, July 10, 1927.

The first method described is that by drop hammer, which is the more economical means for breaking up iron and steel castings, sows, etc. Precautions should be taken to isolate the apparatus on account of dangerous splinters. For heavy scrap such as discarded rolls, dynamite must be used. A method is indicated to make holes in chilled pieces. A number of gas tubes are fitted together, their exterior diameter should be about ½-inch and the thickness about 1/10-inch. One end is connected by a flexible tube with oxygen under pressure and the other end is heated in a wood fire. When the heated end is red hot, oxygen is passed through the tube, and the tube burns. If this end is in contact with the piece to be drilled, the hole will be effected by melting in oxidizing atmosphere. Increased precautions must be taken against accidents which might be due to the explosion.

The FOUNDRY Family Photograph Album

Upper Left

RALPH H. WEST, West Steel Casting Co., Cleveland

Lower Left

T. W. PANGBORN, Pangborn Corp., Hagerstown, Md.

Upper Right

A. B. ROOT, JR., Hunt-Spiller Mfg. Corp., Boston

Lower Right

J. J. Boland, Griffin Wheel Co., Detroit

The Shakeout

DAN M. AVEY, Editor

PAT DWYER, Engineering Editor
FRANK G. STEINEBACH, Associate Editor

CHARLES VICKERS, Nonferrous Editor
EDWIN BREMER, Associate Editor

¶ Fancies Become Facts

DEVELOPMENT of a mechanical process that eventually revolutionized any manufacturing industry, almost without exception has been exceedingly slow. The inventor has had to battle against the inertia of custom and tradition and the active opposition not only of those already engaged in the industry, owners and workmen, but also of a great mass of unthinking common people who regard every mechanical innovation as a body blow at labor. The fact that every great mechanical invention has increased the sum total of the world's output and thus automatically has opened up new avenues of employment, cheerfully has been ignored. Arkwright's spinning jenny aroused violent opposition in England in the middle of the eighteenth century. A small number of hand weavers temporarily were thrown out of employment, but additional hundreds found occupation in making and setting up the new machinery and thousands were pressed into service tending the flying spindles. A small local market was expanded into one that was and is world wide.

HUMAN nature minimizes and is inclined to ridicule anything outside the obvious; anything it cannot understand. Men who still are a long way from the sere and yellow leaf stage of existence, remember the sometimes amused and sometimes contemptuous attitude displayed toward Jules Verne's marvelous flight of imagination in his 20,000 *Leagues Under the Sea.* The Wright brothers initial flights at Kitty Hawk were regarded as the crack brained attempts of a pair of eccentrics whose only redeeming feature was that they jeopardized no person's lives but their own. In the recent war the submarine left no doubt of its deadly practicability, while daring navigators of the air have taken Kipling's "Wings of the Morning" and have flown around the world.

IN TWO recent issues of THE FOUNDRY a prominent engineer has presented a vision of the foundry of the future. With a wealth of detail he outlined the mechanical equipment and the methods of scientific control. To the average lay person the presentation may be highly visionary and apparently beyond the range of possible achievement. Mechanical spinning of cotton once was beyond the comprehension of mankind and the submarine and the airship were classed with the fountain of youth and the Philosopher's stone.

¶ Help Yourself

NO REPUTABLE physician attempts to prescribe until he has ascertained his patient's condition. He must of necessity ask questions regarding certain physical functions before he can effect a cure. The questionnaire sent out several weeks ago by the United States department of commerce to gray iron foundries throughout the country has for its object an accurate determination of the state of the gray iron industry. The department in this case is not attempting to act in the role of the physician, but obviously, the analogy is warranted. Gray iron foundries are not in a healthy state. It is impossible to determine corrective measures until all of the facts are at hand. Therefore, it is the conscientious duty of every foundryman to answer this questionnaire to the best of his ability. In fact without impropriety he might go a step farther and urge similar action on the part of others.

SOME feeling has been expressed that information given in the questionnaire might become accessible to others outside of the department, whether governmental bodies or private organizations. Such is not the case. Information given in the department of commerce is as inviolable as confidences reposed in a physician. Your answer will be known only to responsible executives in the department of commerce and the data which you give will be summarized in tabular form in such a way that it cannot be identified.

Answer the questions.

Send in the questionnaire.

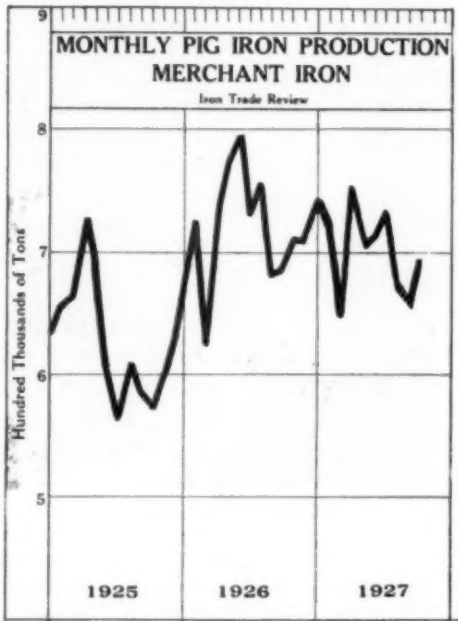
Urge your gray iron foundry friends to do the same.

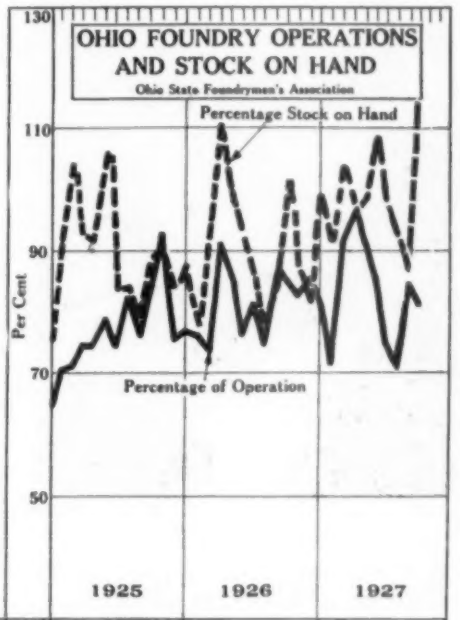
Trade Trends in Tabloid

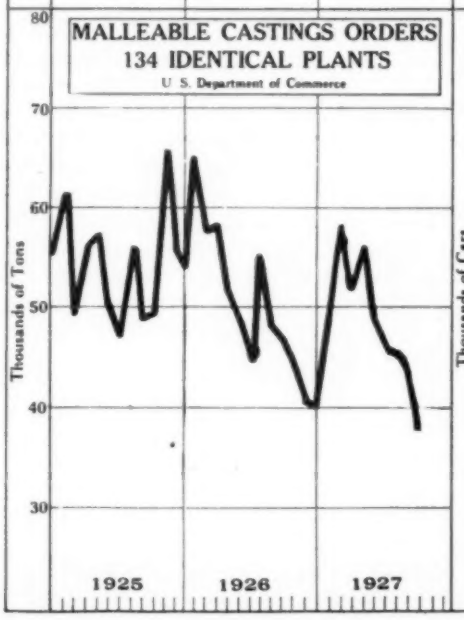
MODERATE recessions are noted in foundry operations, particularly in those lines which in any way depend upon the automobile industry. Close prices and keen competition exist in general jobbing lines. Favorable weather conditions in the late fall have brought a feeling of optimism in rural sections, reflected in purchases of a wide range of necessities by farmers and doubtless will contribute to the expected revival in farm implement lines. Railway purchases are at a low ebb with freight car purchases still below the thousand mark for October and with unfilled orders for locomotives the lowest noted in several years. Stove and radiator plants are operating briskly in contrast with state of business in many other lines. Building construction is slow. Production of pig iron according to statistics compiled by *Iron Trade Review* registered another decline in October. The total for that month was 2,810,231 gross tons, compared with 2,782,500 tons in September, but the daily average output shows a loss for October. Merchant iron production increased from 650,342 tons in September to 692,817 tons in October. Average New York prices for nonferrous metals during October, according to *Daily Metal Trade* follow: Casting copper, 12.976c; electrolytic copper, 13.227, Straits tin, 58.444c; lead, 6.25c; aluminum, 25.145c. Zinc averaged 6.002c, E. St. Louis, Ill.

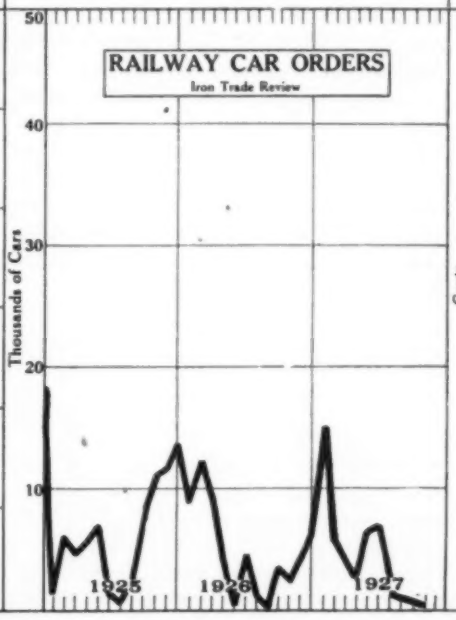
RAW MATERIAL PRICES
Nov. 8, 1927

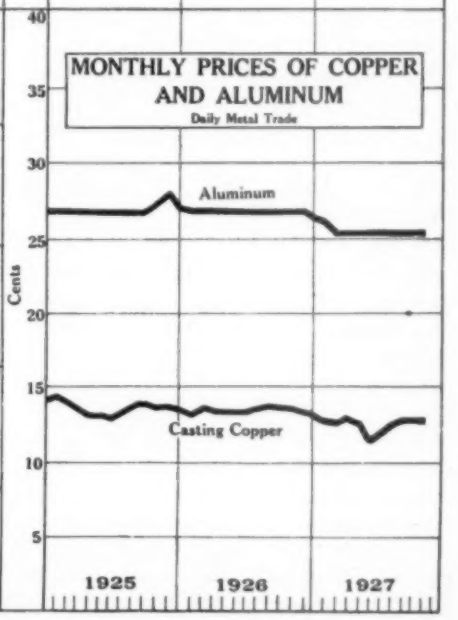
Iron	
No. 2 foundry, Valley	$17.50
No. 2 southern, Birmingham	16.00
No. 2 foundry, Chicago	18.50
No. 2 foundry, Philadelphia	19.76 to 20.26
No. 2 foundry, Buffalo	17.00
Basic, Valley	17.00
Basic, Buffalo	*7.00
Malleable, Chicago	▲8.50
Malleable, Buffalo	17.50
Coke	
Connellsville foundry coke	$3.75 to 4.00
Wise county foundry coke	4.00 to 5.00
Scrap	
Heavy melting steel, Valley	$14.75 to 15.00
Heavy melting steel, Pitts	14.00 to 14.50
Heavy melting steel, Chicago	11.50 to 12.00
Stove plate, Chicago	12.00 to 12.50
No. 1 cast, New York	13.50 to 14.00
No. 1 cast, Chicago	14.00 to 14.50
No. 1 cast, Philadelphia	16.50 to 17.00
No. 1 cast, Pittsburgh	14.50 to 15.00
No. 1 cast, Birmingham	14.00 to 15.00
No. 1 cast, Buffalo	13.00 to 13.50
Car wheels, iron, Pittsburgh	14.00 to 14.50
Car wheels, iron, Chicago	13.00 to 13.50
Railroad malleable, Chicago	13.00 to 13.50
Agricultural Mal., Chicago	12.25 to 12.75
Malleable, Buffalo	14.75 to 15.25
Railroad malleable, Pitts	14.00 to 14.50
Nonferrous Metals	Cents per pound
Casting copper, refinery	13.12½
Electro copper, producers	13.37½ to 13.50
Straits tin	56.37½ to 56.50
Lead, New York	6.25
Antimony, New York	10.87½
Nickel, electro	39.00
Aluminum, No. 12, producers	23.50
Aluminum, No. 12, remelt	18.50 to 19.50
Zinc, East St. Louis, Ill	5.62½ to 5.65











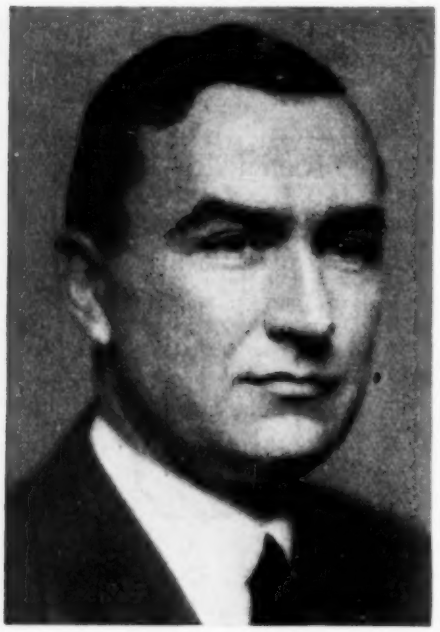
Personal

T. H. Niver has been made purchasing agent of the Bunting Brass & Bronze Co., Toledo, O., succeeding W. F. Volk.

W. J. Kihn has resigned his position as foundry engineer for the Worthington Pump & Machinery Corp., Buffalo.

James Boswell, purchasing agent, Standard Brass Casting Co., Oakland, Calif., has been elected secretary of the company. He will continue to supervise the purchasing department.

Leonard Peckitt, president, Warren Foundry & Pipe Co., Phillipsburg,



ROBERT W. GILLISPIE

N. J., recently was confined to his apartment in New York as the result of an accident when he was struck by a taxicab.

Paul Giegenmueller has been elected treasurer and director of the Monroe Steel Castings Co., Monroe, Mich., succeeding W. C. Curtiss resigned. Carl F. Clarke has been re-elected president, and E. B. Busby, vice president and secretary.

A. R. LeMaster, formerly associated with the Denver plant of the American Manganese Steel Co., has been appointed purchasing agent of the company succeeding O. W. Carlson, who has resigned. Mr. LeMaster will have offices in Los Angeles, Calif.

Samuel P. Bush, president and general manager, Buckeye Steel Castings Co., Columbus, O., has resigned after association with the company for 28 years. John C. Whitridge, vice president, succeeds Mr. Bush as president, and C. B. Goodspeed has been elected second vice president to succeed Mr. Whitridge.

Herman C. Nelson has been appointed assistant purchasing agent, Rock Island Plow Co., with headquarters at Rock Island, Ill. Mr. Nelson has been associated with the firm for 10 years and previous to his recent promotion was on the superintendent's staff at the tractor works of the company.

Receives Promotion

Robert W. Gillispie recently was elected vice president and general manager of the Jeffrey Mfg. Co., Columbus, O. Mr. Gillispie, for many years was connected with the Bethlehem Steel Co., Bethlehem, Pa., in an executive capacity, and joined the Jeffrey organization as vice president and assistant general manager in July, 1926.

Publish First Bulletin on Refractories

The American Refractories institute recently has published the first of a series of technologic papers which deal with a study of the typical clays and grogs used in the manufacture of clay refractories in the principal producing districts of the United States. This first paper is by R. F. Geller, chief, refractories section, bureau of standards, and is "The Significance of the Elasticity and Thermal Expansion of Fire-Clays with Reference to the Spalling of the Fired Product." In summarizing, the author states that the thermal expansion below 200 degrees Cent. and absorption values of the reheated brick bear a sufficiently close relation to their resistance in the spalling test to indicate that they are important factors. Differential thermal expansion between a grog and a clay in the batch may cause rupture. It is believed further studies of materials and factors will account for behavior in service. Copies of the paper may be secured from the American Refractories institute, 2202 Oliver building, Pittsburgh, for 50 cents.

Shape Plans for Exhibit in Philadelphia

The American Foundrymen's association has completed negotiations for the exhibition of foundry equipment and supplies at the forthcoming Philadelphia convention May 14-18. All applications for space received by C. E. Hoyt, Secretary, Marquette building, Chicago, on or before Dec. 5 will be considered as of that date. A general layout of the exhibition space is being sent to all exhibitors.

Final details giving the booth numbers and locations will be submitted first to all firms that file applications for space by Dec. 5 As in the past, exhibits of this character will be allocated to different sections of the exhibit halls and opportunity will be given manufacturers to elect first, second, third and fourth choices.

Elected Vice President

Edwin H. Lundgren, for the past four years general sales manager, Combustion Engineering Corp., New York, recently has been elected vice presi-

EDWIN H. LUNDGREN

dent and general sales manager of the firm. Mr. Lundgren has been identified with the stoker business since 1912 and his association with the Combustion company began in 1921 when he resigned as vice president and chief engineer, Frederick Engineering Co., Frederick, Md. He was graduated from the Swedish Government Technical college with a degree of mechanical engineer. Mr. Lundgren is an authority on design and construction of stokers and the author of numerous technical articles.

Meeting Is Held

The seventh regular monthly meeting of the Wisconsin Gray Iron Research group was held at the Republican House, Milwaukee, on Nov. 2. F. K. Vial, vice president, Griffin Wheel Co., Chicago, spoke on the application of the hot blast to the cupola.

N. S. Lawrence, Officer of Whiting Corp., Dies

Norman S. Lawrence, vice president and director of sales of the Whiting Corp., Harvey, Ill., died Wednesday, Oct. 26, after a brief attack of pneumonia. Mr. Lawrence was born May 9, 1882 at Chicago and was educated in the schools of that city. He was graduated from Cornell university, Ithaca, N. Y., with a degree of mechanical engineer in 1904 and then spent several years with the Robert W. Hunt Co., and the H. M. Byllesby & Co., Chicago. He later joined the Whiting Corp., as an estimator, becoming successively chief estimator, assistant sales manager, and vice president and director of sales. During the past few years, Mr. Lawrence also has been president of the Swenson Evaporator Co., a subsidiary of the Whiting Corp.

Mr. Lawrence had a wide acquaintance in the iron and steel manufacturing field and took an important part in various business organizations. He was active in the affairs of the American Foundrymen's association, the Electric Overhead Crane Institute, and was a director of the Foundry Equipment Manufacturers' association. For many years he was actively identified with the foundry industry. He also was a member of the Flossmoor Country club, the South Shore Country club, the University club, Chicago, and the American Society of Mechanical Engineers. Funeral services were held in Chicago, Oct. 27 and the body was taken to Indianapolis the following day for burial. He is survived by his widow and two sisters living in Chicago.

Obituary

Barron U. Davis, owner of a foundry operating under his name at Niagara Falls, N. Y., died at his home in that city on Oct. 19. He was born in Canada.

Joseph J. Gerretson, for 43 years continuously associated with the Buffalo Forge Co., Buffalo, died in that city recently. He began work with the Forge company as an apprentice molder when he was 14 years old. He later became general foreman of the company, holding the position for the past 20 years.

Hamilton Vose, a pioneer of the middle western foundry industry, died at his home in Milwaukee on Oct. 22, at the age of 73 years. He was a partner in the former firm of Dutcher, Vose & Adams, but retired many years ago. Mr. Vose was a native of Albany, N. Y., and went to Milwaukee in 1860.

D. H. Roberts, founder of the Roberts Brass Mfg. Co., Detroit, one of the oldest manufacturing enterprises of that city, died at his home in Hendersonville, N. C. Mr. Roberts was chairman of the board of the firm which he founded. He also was one of the founders of the McRae-Roberts Co. but left that firm over 20 years ago.

Harry L. Brown, secretary, Ohio Brass Co., Mansfield, O., died recently after an operation for acute appendicitis. Mr. Brown joined the brass company after 10 years with the McGraw-Hill Publishing Co. serving both on the *Electrical World* and the *Electrical Railway Journal*. He was graduated from the University of Michigan, Ann Arbor, Mich., and saw service in the signal corps during the war.

NORMAN S. LAWRENCE

M. Dow Platt, assistant treasurer, Industrial Brown Hoist Works, Cleveland, and Bay City, Mich., died at Flint, Mich., from injuries sustained in an automobile accident. He had been office manager and then secretary-treasurer of the Industrial Works, Bay City, Mich., prior to its consolidation with the Brown Hoisting Machinery Co., Cleveland, and since that time had maintained his headquarters at Bay City.

Publisher Is Dead

David Williams, formerly publisher and owner of the *Iron Age*, New York, and other publications, died Oct. 28 at his summer home at Rogers Rock, on Lake George, N. Y., at the age of 86 years. He was born at Waterford, Ireland, coming to the United States in 1850. Following his graduation from Middletown academy in 1857, he became associated with his father in publishing *Iron Age*, established two years previously. In 1886 he became sole proprietor of the magazine and later established other technical publications. Mr. Williams retired in 1909. He was a member of the American Institute of Mining and Metallurgical Engineers, American Trade Press association and the Engineers club.

English Metallurgist Is Dead

Sir Gerard Albert Muntz, famous English metallurgist, died recently at his home near Stratford-on-Avon, England, at the age of 63 years. He was educated at Harrow, Victoria college, Manchester, Neuwied, Germany and King's college, London. He then became associated with the Muntz Metal Co., and was managing director and consulting engineer from 1896 to 1921. He was chairman of the nonferrous metal committee of the board of Trade, London, in 1916 and of the department of scientific and industrial research in the same year. He also had been a member of the British Nonferrous Metals Research association since 1920.

Will Meet in St. Louis

The American Refractories institute will hold a two-day session in the Hotel Chase, St. Louis, on Dec. 6 and 7. The opening session will be held jointly with the American Institute of Chemical Engineers of which Dr. E. R. Weidlein, director, Mellon Institute of Industrial Research, Pittsburgh, is president. During the second meeting an open forum session will be conducted by M. C. Booze. J. M. McKinley, Crescent Refractories Co., Curwensville, Pa., is president of the American Refractories institute.

Prepare For Power Show

More than 500 manufacturers of power equipment and machinery will be represented at the sixth annual power show which will be held in the Grand Central Palace, New York, during the week of Dec. 5 to 10. The exposition will include machinery for power generation, heating and ventilating, measuring and recording of pressure and volume, and a full line of power transmission equipment will be included in the general display.

Consider Cupola Linings

At a recent meeting of the London branch of the Institute of British Foundrymen, Frank Russell, managing director, General Refractories Co. Ltd., Sheffield, spoke on lining the cupola. He stated that poor lining is caused by ill-fitting brick but if the brick are close grained, of the proper shape and bonded with a correct medium, the brick linings give good service. Mica schist as found in Europe does not have the same physical, chemical and refractory properties as that found in America and is not to be recommended.

He believes that the rammed monolithic lining of a coarse highly refractory material is the best lining, and described the methods of lining with various sands and ganisters. The material used should contain lumps of a heat resisting, siliceous nature such as lump ganister mixed with a standard quality of clay and a limited quantity of water added. Two mixtures should be made; one as mentioned for ramming and another for patching which may be of a slightly less refractory nature to enable it to stick to the walls.

The ganister should be guaranteed to have a certain degree of hardness and possess certain refractory qualities. He also stated that the refractories department of the Sheffield university now is engaged in preparing details for a standard mixture. Mr. Russell said that it does not pay to try to cut either the price or the quality and the sooner it is realized, the better for trade in general. The talk provoked considerable discussion.

Faked Foundry Facts

Taking Up the Slack

Gives Higher Values

An organization of malleable castings manufacturers has compiled averages for the ultimate strength for malleable cast iron giving 53,617 pounds per square inch; the yield point, 36,488 pounds per square inch and the elongation 17.85 per cent in 2 inches. These values were obtained from a large number of test bars submitted by the members for examination during the month. A member of this organization has questioned the values given in THE FOUNDRY Data Sheet No. 686. Further it is stated that while the yield point is higher than the elastic limit, the value of the elastic limit seldom is determined because of the delicate instruments necessary. Hence the value of 35,000 pounds per square inch as presented in Data Sheet No. 686 is said to be too high. The yield point as presented on the same sheet is questioned as being too low. Therefore these values may be substituted for those presented in the data sheet in case this particular sheet is filed.

Chicago Pneumatic Tool Co., New York, has established a branch in the Mills building, El Paso, Texas, in charge of E. J. Coughlin.

Foundry Association Directory

American Foundrymen's Association

President, S. W. UTLEY, Detroit Steel Casting Co., Detroit; secretary-treasurer, C. E. HOYT, 140 South Dearborn street, Chicago; technical secretary, R. E. KENNEDY, 909 W. California street, Urbana, Ill.

The Buffalo Foundrymen
Buffalo

President, J. MCARTHUR, Washington Iron Works; secretary, W. J. WARK, E. J. Woodison Co., 146 Chandler street. Meetings on third Wednesday of the month at 146 Chandler street.

Chicago Foundrymen's Club
Chicago

President, G. H. ROLLINSON, American Brake Shoe & Foundry Co.; secretary, ALBERT N. WALLIN, S. Obermayer Co., 2563 W. Eighteenth street. Meetings second Saturday in each month at the City club, 315 Plymouth court.

Connecticut Foundrymen's Association

President, FRED W. STICKLE, Capitol Foundry Co., Hartford, Conn.; secretary, C. S. NEUMANN, Union Mfg. Co., New Britain, Conn. Meetings are on second Friday of each month in various parts of the state.

Detroit Foundrymen's Association
Detroit

President, J. J. BOLAND, Griffin Wheel Co., Detroit; secretary, ROBERT HOPE, Holley Carburetor Co., Detroit. Meetings third Thursday in each month at the Union League club, 35 Grand River avenue, Detroit.

East Bay Foundrymen's Association
Oakland, Calif.

Secretary, H. L. MARTIN, Marchant's Foundry Co., 4401 East Tenth street, Oakland, Calif.

Metropolitan Brass Founders' Association
New York

President, WILLIAM EMBER, Jefferson Brass Foundry, 62 Delevan street, Brooklyn, N. Y.; secretary WILLIAM E. PAULSON, Thomas Paulson & Son Inc., 97 Second avenue, Brooklyn, N. Y. Meeting second Wednesday in each month at the Building Trades club, 34 West Thirty-third street, New York.

Newark Foundrymen's Association
Newark, N. J.

President, J. L. CARTER, Barlow Foundry Inc., Newark; secretary, W. H. MANTZ, Atlas Foundry Co., Irvington, N. J. Meeting called by president.

New England Foundrymen's Association

President, HENRY S. CHAFFEE, Builders Iron Foundry, Providence, R. I.; secretary, FRED F. STOCKWELL, 205 Broadway, Cambridgeport, Mass. Meetings second Wednesday of each month at the Exchange club, Boston. Outings usually are held in the summer months.

Ohio State Foundrymen's Association

President, C. C. SMITH, Toledo Steel Casting Co., Bancroft and Smead avenue, Toledo, O.; secretary-manager, ARTHUR J. TUSCANY, 5713 Euclid avenue, Cleveland.

Philadelphia Foundrymen's Association
Philadelphia

President, WALTER WOOD, R. D. Wood & Co., Philadelphia; secretary HOWARD EVANS, Union League club, Philadelphia. Meetings the second Wednesday of each month at the Manufacturers' club.

Southern Metal Trades Association
Atlanta, Ga.

President, GEORGE B. COCKER, Gastonia, N. C.; secretary, W. E. DUNN JR., Healy building, Atlanta, Ga.

Pittsburgh Foundrymen's Association
Pittsburgh

President, C. D. CAREY, American Steel Foundries, Pittsburgh; secretary-treasurer, WILLIAM J. BRANT, Wm. J. Brant, Bessemer building, Pittsburgh. Meeting on the third Monday of the month, except in July and August, at Fort Pitt hotel.

Quad-City Foundrymen's Association
Davenport, Iowa

President, HYMAN BORNSTEIN, Deere & Co., Moline, Ill.; secretary-treasurer, H. A. DEANE, Deere & Co., Moline, Ill. Meetings the third Monday of each month, the meeting place being rotated between Moline, Rock Island and Davenport.

Tri-City Technical Council
Moline, Ill.

Chairman F. V. SKELLEY, Tri-City Railway Co., Rock Island, Ill.; treasurer, MAX SKLOVSKY, Deere & Co., Moline, Ill. Combined meetings held only one or two times a year on call.

Tri-State Foundrymen's Association
Cincinnati

President, HAROLD P. RITTER, John A. Oberhelman Foundry Co., 3323 Colerain avenue; secretary, GEORGE W. PIEHL, Wessling Bros. Foundry Co., 1607 McLean avenue. Meetings the second Thursday of each month at the Cincinnati club, Eighth and Race streets.

Twin City Foundrymen's Association
Minneapolis-St. Paul

President, H. H. NOTT, Smith System Heating Co., Minneapolis; secretary-treasurer, C. E. LANGDON, 3849 Lyndale avenue, south, Minneapolis. Meetings monthly at the Athletic club.

Washington Foundrymen's Club
Seattle

President, RONALD KUCHER, Olympic Foundry Co., Argo Station, Seattle; secretary, EDWARD C. GUSTIN, The Prescott Co., 1 West Lander street, Seattle. Meetings second and fourth Tuesdays of each month at the Elks' Temple, Fourth avenue and Spring street.

Drying Oven Is Fired With Powdered Coke

An oven for drying molds and cores has been introduced by l'Outillage de Fonderie, 5 Rue Gretry, Paris, France. The fuel consists of powdered coke discarded from the foundry and is burnt on a special grate. According to the size of the oven, one or more grates are used. Air is blown under the grate. The temperature of the oven which is shown in Fig. 1, remains between 250 and 300 degrees Cent.

Usually the grates are sunk into the ground, but in foundries where it is impossible to dig owing to the access of water, the grates may be placed on the ground either inside or outside the oven. The grates are composed of special bars and the section is calculated to obtain complete cooling. A special shaking device is used to clean the grates. Charging and cleaning doors are located in front of the oven. The air is blown by an electric blower, the volume and pressure of the air being calculated for each particular case. The piping which brings the air to the oven has two openings. Primary air arrives under the grate and furnishes the oxygen necessary for the regular combustion of the fuel. Secondary air arrives above the grate; where, after having recuperated the heat lost in the refractory brickwork it completes the combustion of the gases.

The company also manufactures portable dryers built on the same principles. Several sizes are made, which burn coke dust exclusively. The hearth is made up with refractory bricks separated from the iron shell by angles. Two adjustable openings correspond with an electric blower which blows air in the oven. Part of the air arrives under the grate, the other part circulating between the brickwork and the shell. This air takes up the lost heat and mixes with the gases which are burnt and blown into the mold through a tubing located under the oven. A special device prevents any coke dust being taken up by the air. The consumption of fuel is small. These portable ovens, which are shown in Fig. 2, are used for drying open sand molds or large molds.

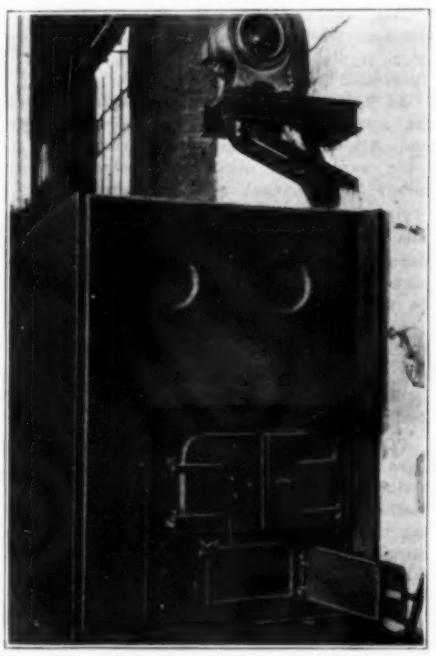


FIG. 1—ONE OF EIGHT FIXED OVENS INSTALLED IN A FOUNDRY IN BELGIUM

FIG. 2—PORTABLE DRYING OVEN FOR USE WITH LARGE MOLDS

Merge Interests

Consolidation of the working organization of two Cleveland foundries is noted in the announcement that the Forest City Foundry & Mfg. Co. and the Walworth Run Foundry Co. both of that city have effected a new organization. The Forest City Foundry, one of the old firms of the city, was established by William Strangward, Sr. and Charles F. Seelbach, Sr. In 1903 the company took over the Walworth Run property, later acquiring a plant known as plant B of the Walworth Run Foundry Co. at Maywood and the New York Central railroad.

The officers of the new incorporation which will be known as the Forest City-Walworth Run Foundries are as follows: P. J. Strangward, chairman of the board; W. J. Strangward, president; C. E. Seelbach, vice presi- and general manager and Walter L. Seelbach, secretary, treasurer. A new office building will be constructed at the Walworth Run plant, 2488 W. 27th street, Cleveland.

Sells Sand Separators

The Royer Foundry & Machine Co., Wilkes-Barre, Pa., has sold sand separators and blenders to the Beach Foundry, Ltd., Ottawa, Canada; the Bessemer Gas Engine Co., Grove City, Pa.; Black-Clawson Co., Hamilton, O.; Central Foundry Co., Bessemer, Ala.; Connecticut State Board of Education, State Trade school, Meriden, Conn.; Fremont Foundry Co., Fremont, O.; Gem City Stove Co., Dayton, O.; Hay Foundry & Iron Works, Newark, N. J.; Pacific Steel Boiler Corp., Bristol, Pa.

The Mayor Fuel Saving Furnace Co., Cleveland, has sold three car-type ovens and furnaces to the Toledo Machine & Tool Co., Toledo, O.

Officers Are Elected

The National Conference of Business Paper Editors of which THE FOUNDRY is a member held its annual meeting at Chicago on Oct. 18 and 19. Officers and directors were elected as follow: Virgil B. Guthrie, *National Petroleum News*, Cleveland, president; Douglas W. Woolf, *Textile World*, New York, vice president, and E. L. Shaner, *Iron Trade Review*, Cleveland, secretary-treasurer. The executive committee is composed of the officers and Paul I. Aldrich, *National Provisioner*, Chicago; R. C. Busby, *India Rubber & Tire Review*, Akron, O.; Kenneth H. Condit, *American Machinist*, New York; Chapin Hoskins, Wheaton, Ill.; W. V. Morrow, *Furniture Manufacturer and Artisan*, Grand Rapids, Mich.; N. C. Rockwood, *Rock Products*, Chicago, and N. G. Shidle, *Automotive Industries*, Philadelphia.

Hear Talk on Alloying

The regular monthly meeting of the Philadelphia Foundrymen's association was held on Nov. 9 at the manufacturer's club. F. K. Ziegler, research and development engineer, Driver-Harris Co., Harrison, N. J., spoke on the effect of nickel and chromium when added separately to cast iron and the effect when added together.

Discusses Cores

The Connecticut Foundrymen's association held its meeting in Hartford, Conn., on Oct. 18. H. L. Campbell, associate professor of metallurgical engineering, University of Michigan, Ann Arbor, Mich., spoke on dry sand core requirements, characteristics of core sands, classification and properties of core binders and coreroom problems.

What the Foundries Are Doing

Activities of the Gray Iron, Malleable, Steel and Brass Shops

Riverside Iron Works, Chicago, has awarded the general contract for its 1-story 50 x 50 feet at 10625 Buffalo avenue.

Structural steel contracts for the shop of the Agricola Furnace Co., Gadsden, Ala., have been awarded the Ingalls Iron Works Co. Inc.

Sharon Pattern Works, 96 Chestnut avenue, Sharon, Pa. Edmond Collins, manager, contemplate building a 2-story pattern shop.

Excelsior Stove Co., 510 South Front street, Quincy, Ill., W. J. Fisher, vice president, will build a 1-story foundry.

Galion Iron Works & Mfg. Co., Galion, O., has awarded the general contract for its new plant 90 x 325 feet, to the W. J. Shirmer Co., Cleveland.

Winchester Foundry Co., Winchester, Ind., has construction of plant under way, but it is delayed now due to non-delivery of steel for the structure.

Southern Ornamental Iron Works, Dallas, Tex., will build a new plant to include a foundry and machine shop, to manufacture ornamental iron elevator doors, fire escapes, etc.

Quality Castings Co., Orrville, O., has been incorporated with $50,000 capital by Frank L. Phillips, W. E. Helier and Frank L. Strauss.

Mattison Machine Works, 545 Blackhawk Park avenue, Rockford, Ill., C. L. Mattison, superintendent, contemplates building a 1-story foundry.

Reps Stove & Heater Co., Clyde, O.,has been incorporated with $50,000 capital by Harvey P. Reppetto, Edwin C. Johnston and Carl Weis.

Flexo Spring Mfg., Brooklyn, N. Y., has been incorporated with $5,000 capital to manufacture metal castings by P. Kapan, 217 Havemeyer street, attorney.

Terminal Pattern & Model Works Inc., 86 Monroe street, Newark, N. J., has leased part of a building at Ferry and Francis streets for a new plant.

Dennison Alloy & Steel Casting Co., Dennison, O., was ordered sold at public auction on Oct. 31 by Judge E. E. Lindsey. John A. Fouts, Uhlrichville, O., is receiver.

Rock Island Stove Co., 200 Fourth street, Rock Island, Ill., Leon Mitchell, vice president, has awarded the general contract for a 1-story plant to Greenleaf Construction Co., Musenfelder building.

Malleable Iron Range Co., Beaver Dam, Wis., has increased capital from $1,000,000 to $2,000,000 for present and future enlargement of its works and equipment. F. W. Rogers is president and general manager.

L. L. Featherstone, 516 Dalzell street, Shreveport, La., contemplates forming an organization to be known as the Southwestern Cast Iron Pipe Co., and plans to build one or more blast furnaces.

Columbia Malleable Castings Co., Columbia, Pa., L. R. Zifferer, president and general manager, contemplates building a plant addition for the manufacture of light grey iron castings.

Alamo Iron Works, San Antonio, Texas, will increase its capital from $1,000,000 to $2,000,000 to provide for additions being made at its Brownsville and San Antonio plants, and the construction of an additional plant at Corpus Christi, Texas.

Sawbrook Steel Castings Co., Cincinnati, has awarded contracts for the erection of a 2-story fireproof pattern storage addition 40 x 130 feet. This addition with the present buildings will supply 14,000 square feet of space devoted exclusively to pattern storage.

Farmers Salvage Co., Bennettsville, S. C., is building its first plant in that city. The company plans to establish plants in southeastern states with foundry and machine shops for rebuilding farm machinery and implements. C. S. McCall is manager of the firm.

Carbon & Alloy Steel Co., Welland, Ont., has been formed and has taken over the plant formerly operated by the Electric Steel & Metal Co., and the Electric Steel & Engineering Co., Welland. The new company immediately will reopen the foundry for the production of steel castings. The plant of the new firm is equipped with two 6-ton electric furnaces. Canadian magnetite ore will be used as a decarburizer in steel making, and the firm will specialize in manganese steel and alloy steel castings from one pound to 14 tons in weight. Sydney F. Wiles, formerly of Sheffield, England, is president and general manager.

Charles H. Birr, Alliance, O., has been appointed receiver for the Canton Steel Foundry Co., on application by the Morgan Engineering Co., Alliance, the principal creditor of the Canton firm. The foundry company plant has been idle for about five years. Liabilities are listed at $1,243,220 and assets at $560,000.

New Trade Publications

NICKEL PELLETS—The American Mond Nickel Co., Pittsburgh, has issued a catalog describing the production and applications of its pure nickel pellets. It is claimed that the pellets are free from cobalt and of a size easily added to cast iron, steel and nonferrous alloys.

SPEED REDUCERS—The Link-Belt Co., Chicago, has published a bulletin describing a herringbone gear speed reducer which it manufactures. Features of construction and application of the reducers are shown by illustrations and text.

HOISTS—Silent Hoist Winch & Crane Co., Inc., Brooklyn, N. Y., has issued a folder showing several types of winches that it manufactures for various purposes.

MONORAIL SYSTEM—Richards-Wilcox Mfg. Co., Aurora, Ill., in a current bulletin describes some results obtained by a foundry using its monorail system for conveying molten iron from the cupola to the casting floor.

NICKEL—International Nickel Co., New York, has published a bulletin giving data on the effect of nickel on the machinability of cast iron.

CONVEYOR FURNACES—W. S. Rockwell Co., New York, has issued three bulletins covering types of furnaces of its manufacture. One is a conveyor furnace for annealing and heat treating metal products without pans or trays. Another bulletin covers conveyor furnaces of other types, and a third its electric furnaces, with technical information of value to furnace users.

NICKEL IN BRASS CASTINGS—International Nickel Co. Inc., New York, has issued a bulletin dealing with the use of nickel in the production of brass castings. It is illustrated and advantages of nickel in the metal are described.

ARC WELDING—General Electric Co., for alloy steel use. This booklet gives the chronology of the development of knowledge and its application in the use of steel alloyed for various purposes.

LIQUID METERS—A meter for measuring liquids, to give an exact record and guard against losses, is featured in a bulletin by S. F. Bowser & Co. Inc., Fort Wayne, Ind. Five sizes are shown, each applicable to a certain volume requirement.

PORTABLE ELEVATOR—A hand power model with non-revolvable base, one of its portable elevators, is described in a catalog section issued by the Revolvator Co., Jersey City, N. J. Details, specifications and applications are included.

STRAIGHTENING ROLLS—Kane & Roach, Syracuse, N. Y., has issued a bulletin covering one line of its straightening rolls. Details and specifications are given. Principles of straightening by means of rolls are set forth. Special types of machines for various purposes are also shown.

WOODWORKING MACHINERY—Defiance Machine Works, Defiance, O., has issued a catalog of its woodworking machinery which is illustrated and contains full data.

ELECTRIC SWITCH—A bulletin covering its across-the-line switch has been issued by the Allen-Bradley Co., Milwaukee, Wis. A wide variety of uses are illustrated where safety to equipment is a consideration.

OPTICAL PYROMETER—Pyrometer Instrument Co., New York, is distributing a bulletin describing a simplified pyrometer it has designed for use where its former type cannot be employed advantageously.

SAFETY CLOTHING—The Safety Clothing Co., Cleveland, has issued a catalog describing its types of safety clothing. The clothing is fabricated from asbestos and leather and is designed for hot metal workers.

POWER LIMITATORS—Edward T. Moore, Syracuse, N. Y., has published a bulletin describing its power demand limitator for controlling electric power loads. These instruments may be used on electric furnaces, steel mill machinery and other electrically driven machines.

OXYACETYLENE HISTORY—Air Reduction Sales Co., New York, has published a folder under that title, presenting briefly the history of oxyacetylene welding. Some of its later uses are explained and a bit of the development of the Reduction company is given.